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THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

The thirtieth convention of the National Electric Light Association opened in the New Willard Hotel, Washington, D. C., Monday evening, June 3, when the associate members welcomed the delegates in the grand ballroom, where a fine display of electrical apparatus was assembled. The decorations were magnificent, and, although compacted, the booths were set off to considerable advantage. It was distinctly a central-station gathering, with interest manifested particularly in those devices which, while insignificant in unit consumption of current, in the aggregate are peak-levelers that the central station is eager to place in the hands of its consumers. There was also a fine display of measuring instruments, both of switchboard and house-feeder types. The restricted space made it impossible to show very large pieces of apparatus, but even with this limitation the display, as a whole, was one of the most creditable the association has held.

The programme was replete with good, timely topics, and although of considerable length, by good management, the sessions were well attended and a vast amount of information was presented and discussed.

Even the weather was propitious. Notwithstanding the fact that for a fortnight all that section of Virginia and Maryland contiguous to the District of Columbia was deluged with rain, Monday witnessed a clear sunrise, with Old Sol trying hard all through the week to present a cheerful countenance to those whose pleasure it was to enjoy the outdoor entertainment features provided by the local committee.

ELECTRIC LIGHTING AND REFRIGERATION.

One of the various plans proposed for helping out the electric light stations in increasing their output and to utilize their various waste products is to make use of the steam in a refrigerating plant. This plan should work out very nicely in connection with the central station, which, during the cold months, sells its exhaust steam for heating purposes. The latter plan has, in many cases, proved to be very remunerative, and has worked well, particularly as it disposes of the exhaust steam at that time of the year when it is greatest in quantity. In one sense, it is unfortunate that there is no demand for heating during the entire year, but when other conditions are suitable, a refrigerating plant may take the place of the buildings to be heated, and this would, of course, create a demand which is greatest in the warm months. A very interesting short discussion of this method of disposing of the exhaust steam is given elsewhere in

this issue by Mr. Howard S. Knowlton. He considers several refrigerating systems, and points out the advantages of these with reference to their cooperation with an electric lighting station.

It is desirable for every central station to dispose of as much of its waste products for profit as possible. A plan which contemplates selling the steam for heating purposes in winter and for refrigeration in summer works out very prettily on paper, but, of course, in actual practice the requirements would be such that all the advantages which might be expected will not be obtained. It is most likely that the two loads—that of heating and that of refrigeration—will overlap somewhat, but it is also probable that when this overlapping occurs that the steam demanded by each will be less than the maximum. It is hardly likely that any station will be able to dispose of nearly all of its exhaust steam in this way, but it is much better to sell some of it at a fair profit than turn it into the air.

Artificial refrigeration may, in another way, help out the central station. Small automatic motor-driven refrigerators are now being introduced, to some extent, and as their advantages become known they will certainly be widely used. These plants do not, of course, utilize the waste product, but consume the direct production of the station. They, therefore, are advantageous in another way, but are desirable since they bring a load to the station in the summer, when it is normally least loaded. It seems likely that the electric lighting industry may become more or less closely connected with artificial refrigeration, and it is probably true that similar relations will be established with other industries, for the supply of convenient and safe power in a city is rapidly becoming one of its most important utilities —one upon which nearly all of its industries depend, to a greater or less degree.

ELECTRICAL MANUFACTURES.

A census of the electrical manufactures in the United States was taken in 1905, covering the production for the calendar year 1904. This is the first time a census of this kind has been taken, and the tables which have been compiled allow a number of interesting features to be pointed out. The general figures have already been published in a table showing the manufactures of the United States, which appeared in the ELECTRICAL REVIEW for December 8, 1906. A recently issued bulletin gives the report in greater detail. A general summary shows that the total value of the electrical products for the year under consideration was $140,809,369. This figure does not, however, include the sum of $18,742,033, representing electrical products manufactured by concerns engaged primarily in the manufacture of other products. There were, in 1904, 754 establishments engaged in the manufacture of electrical appliances. This is an increase of about 200 over the number existing in 1900, when the general census was taken. The capital has increased during the four years, however, about 100 per cent, showing that a good deal of money is going into the business, but the number of companies is not increasing as rapidly, due mainly to the growth of the large companies existing previously, and to consolidations. There is, however, a goodly number of small companies manufacturing many specialities. It is interesting to compare these figures with those of the census of 1880, when the electrical industry may be said to have been started. There were then only seventy-six manufacturing companies. Forty of these were making telephone and telegraph apparatus. The capital engaged in the business was $1,500,000.

The value of the products made by companies engaged strictly in the electrical business, $140,800,000, may be compared with $90,400,000, the value of products for the year 1900. The cost of the materials for the last census was a little over $66,800,000. For the preceding census it was $49,460,000. This increase in the value of the products as compared with 1880 is 620 per cent, although the cost of the materials increased 690 per cent. As compared with 1900, the increase is fifty-two per cent in the value of the products, and but thirty-five per cent in the cost of the materials. The industry employs now forty-six times as many wage-earners as were employed in 1880, and has paid out forty-five times as much for services. It is worthy of note that during the last five years there has been a notable increase in the amount paid out to employés, and there has been no serious strike.

It is also interesting to note the principal items going to make up this magnificent total of electrical manufactures. The first in point of importance is, of course, the dynamo, upon which all else depends. Here the increase is as significant as that in number, for in 1900, 10,500 dynamos were constructed, with an aggregate rating of about 771,000 horse-power. In 1904 a little over 15,000 machines were turned out, but the rating was 1,328,000 horse-power. Thus, the average size has increased from seventy-three horse-power to eighty-eight. It seems, at first, surprising to notice how many more direct-current generators are built than alternating. In 1905 there were nearly 14,000 of the former, and only 1,324 of the latter. This is explained, however, by the fact that the latter machines are used mainly as generators in large stations, while the others are employed in isolated plants, in small places, and for distributing the power generated by the larger machines. These direct-current generators, nevertheless, have an aggregate rating of nearly double that of the alternating-current generators, the figures being 853,800 horse-power for the direct-current machines, and 474,443 for the alternating. The average horse-power for the direct-current machine was sixty-two, while that of the alternating-current generator was 358. Both of these figures show a substantial increase in size over the census taken four years before.

The statistics showing the production of motors are also significant. The total figures are 79,877 machines built in 1905, and 35,604 in 1900. The aggregate horse-power shows a different proportion, however, it being 678,910 in the later year, and 515,705 in the earlier—that is to say, more than twice as many motors were built, but the average size was only about one-half. The street railway motor is an exception to this, as there were

actually less machines constructed during 1904, and the ratings of these had increased. The figures were 12,298 motors in 1904, as compared with 15,284 for 1900; the average rating was forty-four horse-power for 1900, and fifty-eight for 1905.

Another active branch of the industry, and one indicative of the general condition, is the output of incandescent lamps. The increase here was startling, for in 1900 there were less than 26,000,000 lamps turned out, and in 1904 114,296,053. The greater number of these are of the standard sixteen-candle-power rating, although there was a very respectable number—nearly 20,000,000 lamps—of a lower rating, these not including the miniature decorative lamps.

Still another branch typical of development in certain directions is the manufacture of telephone apparatus. The total value of this apparatus reported in the census for 1905 was $15,864,000. For the 1900 census it was $10,500,000.

It is very evident from these figures that the electrical development has gone on rapidly, and at the same time on a most substantial basis. Nearly all of the material which has been turned out is durable and lasts for a number of years, and this represents an increase in property, for although one frequently hears of old apparatus being replaced by new, this, comparatively speaking, accounts for but a small percentage of the yearly output. Moreover, the great increase in small appliances indicates how the use of electrical apparatus is spreading in all fields; in fact, a goodly number of the many motors manufactured are placed in mills and shops, where they take the place of other power appliances.

TRANSMUTATION OF MATTER.

At a recent convention of the German Electrochemical Society, a report of which is given on another page of this issue, a group of papers dealing with the subject of radioactivity were read, all of which gave interesting results of experiments in various phases of this phenomenon. One of these was of particular interest, because it seemed to give pretty conclusive evidence of the production of helium by the disintegration of radium. Another gave the results of an investigation to determine whether the apparent change in weight which had been observed was real. This latter paper is of much importance, not because of the results which it gave—in fact, these were negative—but because of the emphasis which it put upon the necessity of avoiding every possible source of error in the study of this new and striking branch of physical science. With the material sealed within a glass vessel, there was an apparent change in weight easily measured in a balance. This seemed at first good evidence of a loss of weight, as the tube became lighter; but the difference in weight was finally found to be caused by the changes in temperature of the tube and its contents, due to the chemical changes going on within it. This increase in temperature, by causing a slight increase in the volume of the tube, decreased its specific gravity, and thus gave rise to the apparent change in weight. When the tube had come to a stable condition and reached its original temperature, the weight was found to be identically what it had been when the tube was sealed up. Thus, it will be seen that all apparent effects may not be real, no matter how carefully the observations were made, and whenever they are in disagreement with our fundamental ideas of physics and chemistry, they should be scrutinized closely and put to every possible test. The new phenomena are puzzling enough, and are changing our ideas of matter rapidly. There is therefore all the more need to be careful.

WIRELESS POWER FOR SHIPS.

Occasionally, prophesies have been made by visionaries, as well as others, that the day of the steamship will soon be over, and its place will be taken by an electrically propelled vessel. This prophesy was given more weight than usually attaches to such forecasts when it was reiterated by Sir Hugh Bell, in his presidential address delivered recently before the Iron and Steel Institute, of Great Britain. He said that the old coal-burning machinery would be displaced, and that vessels with little or no machinery on board, with barely any crew, will speed on their way, drawn by the electric force generated at Niagara and transmitted over the ocean by wireless telegraphy. He thought, strange as this forecast might seem, it was no more incredible than what had happened during the preceding century.

The prophesy does seem somewhat optimistic at the present time, particularly if one would apply to the process contemplated our present knowledge of wireless transmission of power, even when employed for such infinitesimal work as affecting a delicate wireless receiver. But, theoretically, the thing is not impossible, and we can only hope that it will become yearly more probable, and that eventually the ocean steamer will be as independent and as simply controlled as a trolley car.

THE ACETYLENE BLOW-PIPE.

The electric current has given us several direct means of obtaining high temperatures, but there is an interesting and useful secondary method resulting from the application of the electric furnace. This is the acetylene blow-pipe, in which acetylene gas takes the place of hydrogen in the ordinary oxy-hydrogen blow-pipe. The advantages of the system are the higher temperature obtainable, which is said to be over 6,000 degrees Fahrenheit—some 2,000 degrees higher than that given by the oxyhydrogen flame. Acetylene is easily produced by the simple method of submerging calcium carbide in water. There is no danger with properly constructed apparatus, and there is no difficulty in storing the material. Further, the electric furnace makes available materials which, by a similar treatment, give off oxygen gas. Thus, by means of two small gas generators and two solid chemicals, one can obtain, whenever necessary, this intense temperature, which may not only be employed for melting materials, but is used for welding steel and cast-iron, and even for cutting these metals. The system is now in use, to some extent, both in this country and abroad. Its simplicity and ease of control are much in its favor, and its use makes possible considerable improvement and simplification in the manufacture of many articles of metal.

The Bunsen Society Meeting at Hamburg.

By John B. C. Kershaw.

THE fourteenth annual meeting of the German Society of Electrochemists, held at Hamburg, May 9-15, was a successful gathering, about 200 members and forty ladies being present at the meeting.

The interest in the papers and discussions was well maintained; the group of papers upon "Radioactivity and the Dissociation of the Atom," placed first upon the programme, being perhaps, the most attractive and valuable of the contributions to this year's conference.

Among others present at the Hamburg meeting were: Nernst, Landolt, Richards, Abegg, Bodenstein, Will, Danneel, Foerster, Haber, Le Blanc, Lepseus, Löb, Luther, Marckwald, Schenck and Tammann. Dr. H. T. Von Böttinger, one of the honorary members of the society, and Professor van't Hoff, both of whom are usually present at the annual meetings of the society were prevented from attending this year's meeting by illness, and Professor Ostwald, who has recently retired from his active teaching work in Germany, was another notable absentee. Dr. H. T. Von Böttinger communicated through the council his intention to provide the necessary funds for a Bunsen medal which is to be presented every two years, commencing in 1908, for valuable research work in the domain of electro and physical chemistry. The selection of the recipient will be left in the hands of the council. The medal will be of gold and worth between $120 and $145.

The council also announced that Vienna had been selected as the meeting place for the 1908 gathering, but that the date had not been fixed.

I—PAPERS AND DISCUSSIONS UPON RADIOACTIVITY AND THE THEORY OF ATOMIC DISSOCIATION.

The first paper upon this subject was presented by Professor Voller, of Hamburg, who gave a short descriptive account of radioactive phenomena, illustrated by experiments; twenty milligrammes of radium bromide, lent to the author by Direktor Hausreth, of Magdeburg being utilized for this demonstration.

Professor Marckwald, of Berlin, followed with a paper dealing with the chemical properties of the radioactive elements and their methods of separation. As regards the general method of preparing radium from the earths containing it, Professor Marckwald stated that the earth should be opened up with sulphuric acid, and the mixture of insoluble sulphates contained in the residue treated with a dilute sodium carbonate solution and finally with a concentrated solution of the same salt, in each case at the temperature of ebullition.

The radium and barium sulphates are only decomposed by the last-named treatment, and having separated these from the other bases, the radium is finally separated from the barium salt by repeated crystallization of the bromide into which form both carbonates are converted. The purity of the salt is generally tested by means of spectrum analysis, but the results of this are often misleading. Demorzais recently obtained a spectrum containing no barium lines from a sample which had an atomic weight of 175 and therefore contained at least fifty per cent of barium. An electrolytic method of separation can also be employed. When using a mercury cathode, more radium than barium is obtained at the negative electrode. This method, like all other methods of separation, must be operated upon the fractionating principle, the process being repeated many times until approximate purity is obtained. A third method of separation described by the author depends upon the use of sodium amalgam, which absorbs more radium than barium from mixtures of the two elements. A fourth method of separation has been proposed by Thiel, and is based upon the different dissociation temperatures of the two carbonates. If the mixture of barium and radium carbonates be heated in an electric furnace at a high temperature, one of the carbonates will be found to dissociate before the other.

The third paper of this series was contributed by Professor G. Meyer, of Freiburg, who discussed the formation of helium from radioactive elements. The determination of the helium produced by this change and of the characteristic emanations given out by the helium are found to be much disturbed by the presence of nitrogen, and it is therefore necessary to exclude this gas. Meyer then described the well-known experimental work of Ramsay and of Geisel relating to this subject. These investigators found helium lines in the spectrum obtained from closed tubes containing radium one month after they were sealed up. In order to meet the objection raised that this helium may have been first absorbed and then occluded by the uranium residues with which the test was made, Heimstedt and Meyer carried out the following modified form of this experiment. Fifty milligrammes of radium bromide were enclosed in a glass tube, to which a Geissler tube was connected, and after cooling the apparatus by means of liquid air, and exhausting it of all gases, hydrogen was passed through the Geissler tube for three days, and the whole then sealed up. Under these conditions the tube glowed strongly, the light rays gradually faded and after a period during which unknown lines appeared in the spectrum and then vanished, the well-known helium lines appeared at the end of four months. As a further test the radium salt was heated in a vacuum in order to remove all occluded gases. No helium lines could be observed in the spectrum until after the expiration of fourteen days. A still more drastic test was then carried out as follows: forty milligrams of radium were heated in a quartz-glass tube until the radium sublimed and deposited at the other end of the tube. The tube was then filled with hydrogen and allowed to stand until the next day, when the heating to the sublimation point of the radium was repeated. At the end of some weeks the helium lines however once more appeared. In conclusion Meyer discussed the views of Rutherford concerning the emanations from radium of α particles which are chemically combined with helium, and the fact that one atom of the emanation yielded one atom of helium. Radiums A, B, and C yield α particles, and therefore it might be expected that one part of the emanations would yield three parts of helium. Rutherford had calculated that in every second one gramme of radium produced 2.5×10^{-11} atoms of helium, while Ramsay calculated from direct experiment that in one year one gramme of radium would yield twenty-five cubic millimetres of helium. The method of determining the amount of helium present in the latter case was based upon the comparison of the spectrum of the tube containing the unknown quantity of helium, with that of a second tube containing a known amount. In order to remove the impurities from the mixed

gases contained in the tube, absorption by carbon prepared from cocoanut, or by fused calcium was employed. In the discussion upon this paper Arndt pointed out that calcium volatilized at a temperature below its melting point, and in this state combined with all gases with the exception of the inert or "noble" gases.

The fourth paper of the series by von Lerchs upon "The Nature of the Radioactive Emanation," and the fifth by O. Hahn upon "The Hypothesis of Atomic Dissociation" contained merely a résumé of the existing knowledge upon these subjects and embraced no new matter; while that of Levin upon "Some Consequences of the Theory of Atomic Dissociation," discussed the age of the earth and the probable temperature of the moon.

The final paper of this series was contributed by Professor Henrich, of Erlangen, and dealt with "The Radioactivity of the Air and Water from Mineral Springs." A rapid method of determining the radioactivity of a water had been worked out by Günther and Tegetmeyer of Brunswick, and was based upon the measurements of the conductivity by discharge of an electroscope after shaking the water in a closed vessel with air. Maihe on the other hand had proposed as a measure of the activity the fall of electromotive force measured in thousandths of a volt which occurred in one hour with one litre of the water or air, and a table was exhibited showing the radioactivity of a large number of spring waters expressed in this unit of value.

The highest value was found in the water from the springs of Ichia. The activity was found however to vary enormously—waters of the same chemical constitution being examined and found to show radioactivity ranging from three up to 150 Maihe units.

Samples from the same spring also showed marked variations and after heavy rains the suspended matter in the spring water was often found to be more radioactive than the water itself. The spring is always found, however, to be most active at its original source, and the longer it is left in contact with air, the weaker this activity becomes. From the incrustations left by the water in its flow over rocks, one can obtain small amounts of radium. The cold springs are more radioactive than the hot.

In the general discussion upon these seven papers it was specially noted that the experimental evidence brought forward showed that the change from radium into helium occurred equally quickly at the temperature of liquid air, as at a red heat. Nernst explained this fact by the very large amount of heat energy produced and liberated by the atomic dissociation going on within the mass, as compared with that communicated to it directly from external sources, and deduced from it the proof that in this change one was not dealing with an ordinary chemical process or reaction.

Dr. G. Tammann raised objections to the statement that in all uranium minerals the proportion between uranium and the radium is expressed by the ratio $1 : 3.8 \times 10^{-7}$, and argued that in different portions of the mineral the ratio was probably quite otherwise. Dr. Tammann also raised the question whether elements like radium in process of change could be brought within the periodic system of the elements, and this subject was referred to by many who joined in the discussion. Brauner expressed the view that it was quite possible that many of the existing gaps in the periodic system had once been filled by elements that had undergone complete dissociation and which, therefore, might now be regarded as dead elements.

Dr. H. Landolt gave details of experiments, the results of which seemed at first to support the theory of atomic dissociation, but later were found to be capable of explanation by application of the ordinary laws governing chemical and thermal change. While carrying out a study of chemical reactions in sealed glass tubes extending over many years, Dr. Landolt had observed a gradual and slight loss of weight of the materials which lay outside the range of experimental error. This loss was at first attributed to some kind of emanation, like the emanation of radium, which passed through the glass walls of the tube. Further study of the phenomenon had, however, proved that this loss of weight was due to slow thermal changes in the mass contained within the tube. This thermal change caused a corresponding change in the volume of the vessel, and as a corollary slight variations in weight. After many weeks had elapsed the original temperature and volume were once again attained, and the weight of the tube and its contents was then found to be exactly that first observed.

Marckwald closed the discussion by stating he was convinced that in may respects the theory of radioactivity and of atomic dissociation required further experimental evidence in its support before it could receive unqualified acceptance from chemists and electricians.

II—OTHER PAPERS OF INTEREST TO ELECTRICIANS.

1. Professor R. Luther, Leipzig—"Electrolytic Activity Phenomena." The author showed that chloric acid could be made more active electrolytically by first reducing it to chlorine dioxide ($Cl\ O_2$) by means of vanadium. This element forms vanadic acid when brought into contact with chlorine dioxide, and the acidation change is then reversed,—the reaction thus becomes cyclic in character. If vanadium be introduced into a galvanic element containing chloric acid, the electromotive force of the latter will be markedly increased. This increase can be audibly demonstrated by the louder ringing of an electric bell inserted in the same circuit.

2. Professor F. Haber, Karlsruhe—"A Gas Refractometer." This instrument can be employed for determining, by direct observation, the percentage of carbon dioxide gas in the exit gases from furnaces and boilers, and is therefore of some interest to electrical engineers. A brief illustrated description of it has already appeared in the issue of November 24, 1906. Professor Heber described the instrument in detail, and gave a demonstration of its use by determining the CO_2 in the waste gases from a petroleum lamp. The refractive index of gases can be determined by aid of this instrument to the seventh or eighth decimal place, and the percentage of CO_2 in exit gases can therefore be estimated by it with an error of only one-tenth of one per cent. The cost of the instrument, which is being placed on the market by Fliss, of Jena, will probably be between 800 and 1,000 M ($200-$250).

3. Dr. Arndt, Charlottenburg—"Researches Relating to the Electrolysis of Fused Salts." The researches upon the conductivity of fused salts, described by the author in a paper read at the 1906 meeting of the Bunsen Gesellschaft, had been continued by A. Gessler, the behavior of the following salts being examined by this investigator: Silver chloride, bromide and iodide, sodium bromide and iodide, potassium bromide and iodide, calcium bromide and iodide, strontium bromide and iodide, and sodium metaphosphate. The increase of the conductivity (K) with increase of temperature is a straight line curve for the salts with a monovalent action, but the curve bends down towards the base line with the divalent salts. Of the salts examined in this research, silver chloride possessed the highest conductivity, and sodium metaphosphate the lowest. With mixtures of potassium and sodium chlorides, the con-

ductivity of the mixture can be calculated from the conductivities of the separate constituents. The specific gravity of fused salts is most easily determined by means of a float made of platinum; the fused silver salts, however, require a different method.

The research was intended to include mixtures of sodium metaphosphate and boric acid anhydride, the second of which at 900 degrees centigrade has the very low conductivity represented by $K=2.1 \times 10^{-5}$. When mixed with fused sodium metaphosphate marked contraction occurs, and the fluidity of the fused mixture or solution of sodium metaphosphate in boric acid anhydride undergoes great alteration. The author gives figures to show that the fluidity expressed in C. G. S. units and the conductivity of the solution vary inversely for all degrees of conductivity, and that consequently the product of the two is a constant. The electrolytic dissociation of the sodium metaphosphate when dissolved in boric acid anhydride, is, therefore, independent of the degree of concentration of the sodium salts.

4. Professor F. Foerster, Dresden—"The Influence of Temperature Upon the Electrolytic Deposition of Metals." The author of this paper described experiments which seemed to support the theory that many metals became more allied to the noble metals, with increased temperature of deposition, and that when deposited under these conditions with increasing electromotive force, a separation from other metals is possible. Owing to the lateness of the hour at which the paper was brought forward only a very brief summary of the experimental work and the views based upon it, was given by the author.

CONVENTION OF THE INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

CHICAGO, ILL., JUNE 4, 5 AND 6.

(Special Telegram to the Electrical Review.)

CHICAGO, June 5.—The annual convention of the International Independent Telephone Association was opened at the Auditorium Hotel, Chicago, Ill., June 4. There was in attendance the largest delegation known in the history of independent telephony. The manufacturing companies made exceptional efforts to have their exhibits complete, and full lines of standard independent telephones, switchboards and equipments were shown.

The first session of the convention was called to order with James B. Hoge, the president, in the chair. An address of welcome was delivered by Dr. Evans, commissioner of health, Chicago, in place of the Hon. F. A. Busse, mayor. Dr. Evans' address was received with great applause. He fully explained Chicago's attitude toward the independent service and emphasized the fact that Chicago wants connection with the outside independent telephone subscribers.

Dr. Evans was followed by John M. Glenn, secretary of the Illinois Manufacturers' Association. Mr. Glenn explained how anxious his association is to obtain an ordinance from the city of Chicago in order that the independent service may be brought to the city. He also explained the fight now being made in the council for this ordinance.

Mr. Glenn was followed by H. D. Critchfield, of Milwaukee, who delivered a responsive address giving the Independent telephone company's side of the question, explaining how anxious it is to enter Chicago, and how important it is for Chicago to permit the many independent telephone subscribers to have direct communication with the telephone users in Chicago. Mr. Critchfield quoted figures showing the growth of the independent systems since the birth of the movement. These showed how rapid the growth of the independent movement has been, and also brought to the attention of the city the importance of having independent service. Mr. Critchfield drew the attention of the convention to the steps already taken by the Illinois Manufacturers' Association, stating that it has offered to put up $5,000,000 in cash as a forfeit in case an ordinance is granted it and it does not build a plant and place service at the disposal of subscribers in Chicago.

President Hoge then delivered his address. He went into details fully explaining the work done by the association during the past year, and also called attention to the importance of cooperation between the different independent telephone companies and the various committees of the association.

Mr. Hoge was followed by J. A. Harney, assistant secretary, who delivered the secretary's report. This gave in detail the work done by the secretary and his associates. The great strides taken by the association were discussed. The report was most encouraging, showing how great the success of the association has been during the past year.

The secretary's report was followed by the appointment of several committees. The auditing committee reported, showing that the association is in a satisfactory financial condition.

Short talks on practical subjects were delivered, the following being discussed: construction problems, shield advertising, and collection methods. A great deal of interest was shown in these discussions.

A large number of the delegates in the evening took advantage of the outing arranged by the association at Sans Souci Park. Tickets had been distributed and an enjoyable evening was had. Sans Souci Park is one of the favorite resorts of Chicago, and the management of the park did its best to entertain the delegates to the convention.

L. W. M.

Illuminating Engineering Society.

The first annual convention of the Illuminating Engineering Society will be held during Old Home Week at Boston, Mass., Tuesday and Wednesday, July 30 and 31. Members attending this convention can either take up the matter of transportation individually, or they can secure the reduced rate of fare announced for Boston Old Home Week. Full details concerning hotel accommodations, and any other information, may be had from J. H. Griffin, Jr., at the business headquarters of the society, room 728 Old South Building, Boston. The convention hall has not yet been decided upon, but will be announced shortly.

An excellent programme of papers from leading representatives of the various interests which the membership of the society includes is being arranged, a goodly number of papers having already been promised. In addition, an interesting exhibition of illumination appliances and other apparatus is being laid out, while the notable examples of decorative illumination which will be seen in the streets of Boston during the week will themselves be well worthy of study.

Although it is planned to have a business convention, many entertainment features will be provided, quite apart from the opportunities for amusement afforded by the festivities of Old Home Week. The latter include military, civic and trade parades, illuminations and electrical pageants.

John Campbell, chairman of the general convention committee, Old South Building, Boston, is making every effort to have the convention a success, and he hopes that in this he will receive the support of the members of the society, and that all those who can do so will not fail to attend.

The Thirtieth Convention of the National Electric Light Association.

Washington, D. C., June 4, 5, 6 and 7.

THE formal sessions of the thirtieth convention of the National Electric Light Association was opened at the Hotel Willard, Washington, D. C., Tuesday, June 4, at 10.15 A M.

President Arthur Williams, of New York, called the meeting to order and said: "I have very great pleasure, ladies and gentlemen, in calling to order the thirtieth convention of the National Electric Light Association."

General George H. Harries was introduced and said in part: "Some years ago, one of England's most eminent divines, in response to a question from me as to what in the course of a twelve-months' tour of this country seemed to him to be the most remarkable thing, replied—'that you should acknowledge at the seat of your Government that your form of government is a failure.' Now, without discussing that, let me say that while our form of government here in the District of Columbia is wholly unlike the municipal governments of the country, largely because of complete Federal control within the Federal district, we have nevertheless a form of government which many of you may envy. We have a thoroughly clean government. I perhaps would be exaggerating things a little, and Mr. McFarland would call me to order if I were to say it is always right. There have been times when the Potomac Electrical Power Company and the Washington Electric and Railway Company differ with the commissioners, but it is not important that they be arraigned here for their weakness at such times."

Commissioner McFarland then addressed the convention, after which President Arthur Williams delivered his annual address, an abstract of which is given herewith:

It gives me pleasure to welcome the delegates and those with them to our thirtieth convention. This is the second meeting of the association in this beautiful city—the former was held here early in 1894—slightly more than thirteen years ago.

Then the active, Class A, membership included 107 companies; now it includes 709 companies; then there were 112 associate, Class D, members; now there are 151; then we had 27 honorary members, now 31; in these three classes there were then 246 members, now there are 884 members.

MR. ARTHUR WILLIAMS, PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION, 1906-1907.

Since that convention two membership classes have been added—the B, now including 317 members, and the E, including 85 members—a total of 402 members, making at present an aggregate in all classes of 1,286 members.

Then the dominating thought was technical, mechanical and electrical. The American, in whatever he does, moves rapidly. In operating limitations development toward the practical, if not the ideal, has about been reached, and now the predominating thought in a convention such as this, while giving due regard to engineering problems, tends more especially to the commercial development, and to broad questions of management which, in the highest sense, affect our relations with the general public.

During the year the association's committees have rendered splendid service. To attend meetings some of the members have traveled great distances. Their reports should be received with close attention. Perhaps passed over sometimes without much apparent notice, undoubtedly the reports of our committees have done much to mold the opinions and methods of our membership.

Questions have arisen recently concerning the rating of the so-called two thousand candle-power municipal arc lamps. Those of our members who have occasion to refer to this matter would do well to consult the report of the Special Committee on the Rating of Arc Lamps, appearing in the proceedings of the 1894 convention, which will be referred to more fully in the report of the Committee on Street Lighting Specifications. Recent improvements in arc lamps and the possibility of their adoption for street illumination has made it seem desirable to consider the practicability of returning in some form to a candle-power rating. It was for this purpose that the committee was appointed, of which our first vice-president, Mr. Dudley Farrand, is chairman. Several meetings were held during

the year, each attended by every member, and the report should be awaited with a great deal of interest.

Corporation accounting is receiving wide-spread attention. That which is desirable for one company would seem so for another, allowing for local differences. Your committee on this subject, of which Mr. H. M. Edwards is chairman, consists of eminent accountants; its report is most complete and the efforts of our association should be toward its general adoption, at least basicly, throughout the accounting methods of our industry.

Cooperation promises to be one of the keynotes of the century's progress. As elsewhere, it extends into the field of advertising. The committee appointed to consider the subject, of which Mr. W. W. Freeman is chairman, has worked in conjunction with the Cooperative Electrical Development Association, and a report of its conclusions will be made at a later session.

In the movement toward the municipal socialism—which for a time threatened to sweep the country—there seems to have been a pause. As opposed to it, Chicago and London have won notable victories during the year. This appears to have been done entirely through an educational appeal to public reason. The facts for and against the movement have been fully and clearly stated and the public was not slow in deciding between right and wrong nor long in making known its decision.

Fair play may be expected from the American public. But it must have facts not personal opinions with nothing behind them other than "mere assertion." For many years the public has heard only one side of the question, and, therefore, could not do otherwise than form a one-sided—and as subsequent events have proven—a wrong opinion. This pause should not be considered as a victory. Rather simply an indication that the public is willing to hear both sides and to render its opinion in favor of those who, in their treatment of the public, are in turn entitled to public support.

The power of public opinion, and the resistless force it exerts when centered upon a given subject, has been one of the object lessons of the year. It promises to become increasingly a predominant feature in the conduct of the affairs—political, corporate and individual—of our American municipalities. It should be carefully studied, shaped where wrong and always reckoned with.

Our own is one of the industries through which public opinion may be greatly affected. The men who are in attendance at this convention are in a position, personally and through their subordinates, to make an impression for good or for ill upon a large percentage of our eighty millions of population. Whether our rates are fair and made without discrimination; whether our representatives are competent and courteous; whether our service is of high standard, all are elements which go to make public opinion favorable or unfavorable, and in this there is no detail too small or seemingly too unimportant to receive attention. We shall surely reap what we sow.

It would be desirable could our association agree upon some approximately common method, or methods, of charging for electric current. If one method cannot be considered best, several eventually might be recommended, each possessing recognized elements of fairness to the public as well as to the supplying companies.

At the last convention in this city the question of pending legislation in the various states of the Union was given consideration. It is to-day a live question. To obtain and send this information to our members seemed almost impossible until one of the reports of the Public Policy Committee became available, which showed not only the practicability of the plan, but how well it could be carried out. Central station managers are usually much engaged with their work, and without notice, hostile and unfair legislation may at any time be passed. Were there a method through which every member in a given state could be advised of such measures, combined and united action would go far toward preventing results harmful to the industry, and, reactively, to the general public.

In closing it is but fair to say that during the year the secretary's office has been conducted admirably. One not directly connected with the affairs of the association can not realize the amount of work done and the responsibility resting upon these offices. Warmest praise is due our secretary and treasurer, W. C. L. Eglin, and our assistant secretary and treasurer, Miss Harriet Billings.

The secretary read an invitation from the Consolidated Gas, Electric Light and Power Company, of Baltimore, and also from the McCall's Ferry Power Company, to visit the plants of these companies; also an invitation from Dr. Clayton H. Sharp, president of the Illuminating Engineering Society, for the members to attend the annual meeting of that society to be held in Boston, July 30 and 31. The secretary also read invitations to hold the next annual meeting at Asbury Park, Atlantic City and Boston.

T. Commerford Martin presented the report of the committee on progress in abstract.

This report, as usual, reviews the progress in the electric lighting industry during the year, pointing out interesting developments in station practice, in the making of new types of incandescent and arc lamps, and the progress made in the introduction of electric power in the factory and home.

Mr. Paul Lüpke, of Trenton, presented his paper on "Accidents."

Mr. Lüpke holds that the construction of a central station means something more than the mere mounting and hoisting of various kinds of apparatus. Matters should not be left absolutely in the hands of the consulting engineer. Violence to local conditions may be done in order to fit the engineer's rigid standards and preconceived ideas. Everything that will help keep the plant clean should be provided. Bric-a-brac and business do not mix; ornaments earn no dividends. With regard to the men, the author considers that they should be green whenever this is feasible. The central-station manager should have a standard of his own, and train his hands up to that standard. An important consideration in the elimination of accidents is the care which is given to the correction of defects as they appear. No progress will ever be made while accidents are thought lightly of. When a thing happens for the first time there may be some consolation in the fact that it is an accident in the pure sense of the word, but if it occurs again, and could have been corrected, it ceases then to be an accident and is the result of pure neglect.

There was no discussion, and the paper, "Power-Factor Correction," by F. D. Newbury, of Pittsburg, was read.

Low power-factor has two serious results: It limits the capacity of the electrical part of the system by loading it up with unproductive current—that is, current for which no revenue is obtained; and it means poor regulation. Low power-factor means that unless the system has been consistently designed for the power-factor at which it is operating, the different parts of the system are unequally loaded. If the engines are underloaded, the possible revenue is curtailed; if the engines are carrying their rated load, the electrical part of the system is overloaded, with attendant troubles and poor service to the customers. A caution is needed

in considering the bad effects of low power-factor against concluding that a high power-factor is always better than a low power-factor, without considering the means by which the higher power-factor is obtained. The power-factor may be raised by increasing the inductive load or by increasing the energy load. High power-factor obtained by decreasing the inductive load will always mean a gain; high power-factor obtained by increasing the energy load will only mean a gain provided the increase in energy load is accompanied by a corresponding increase in revenue. The synchronous motor presents a practicable means for raising the power-factor by adding to the system an additional source of magnetization current that will supply magnetization current to the inductive apparatus. Where there is a suitable load for a synchronous motor, there is now very little question regarding the advisability of its installation in cases where improvement in power-factor is a consideration.

The "Question Box," by Paul Lüpke, of Trenton, editor, was presented by Paul Spencer, who read the introduction.

It was recommended by Paul Lüpke, editor, that a standing committee be appointed, to which members of the association desiring information may appeal for such information, and either of the committee's personal knowledge, or through information obtained by correspondence with other members, the applicant for information may be immediately informed as to the point concerning which he desires to be advised, and that the question and the answer will then afterward be included and presented as part of the question box of the year.

H. T. Hartman thought the suggestion would add very greatly to the efficiency of the "Question Box." There is no doubt but that men could be selected by the association, each a specialist in his own line, who could give possibly very much better answers than the average which is secured by the "Question Box."

Paul Spencer thought that Mr. Lüpke's recommendations should be given very careful consideration.

W. H. Blood, Jr., presented his report on "Insurance and Kindred Matters."

This explains, in some detail, the work of the executive committee appointed to report upon insurance and kindred matters. It has been felt for some years that more attention should be paid to the work of the Underwriters' National Electric Association. A representative of the association last year took an active part in this work, particularly with reference to changes in the National Electrical Code. In this way certain changes, which would have reacted seriously for lighting companies, were prevented. The report says that there is a tendency on the part of certain inspectors and contractors to insist upon the most expensive kind of electrical construction, and this, in many cases, is a hardship, and it discourages the use of electricity. This tendency should be combated strongly. The committee was also able to assist member companies of the association with expert advice in legal actions brought against them by insurance companies.

W. M. Clark asked whether there were any regulations for the underwriters regarding the fouling of electric wire by gas-pipes, etc., after the electric wiring has been installed and passed on by the inspectors.

Mr. Blood replied to the first question that there were a number of rules proposed which would have had the effect of ruling out the use of knob and tube work entirely. Following that was a rule intended to rule out the use of molding for show windows, which meant that nothing but iron conduits could be used in show windows. As hundreds of show windows use moldings, and it seems to serve the purpose very well, it appeared like a great hardship on some of the smaller companies that that form of wiring should be ruled out. As a matter of fact, on reconsideration it was left in. The proposed rules in regard to the knob and tube work were fought very considerably, and they were allowed to stand as at present. As to the consideration of the life hazard, he had a number of conferences with the underwriters in regard to that, and their position in the matter he thought is very commendable. The rules are primarily gotten up as a safeguard against fire. The underwriters took the position that if the wiring is in such a position or condition that death is liable to ensue, that it removes from the building or property the service of some one who might be of great value in putting out fire which may come at the same time through faulty wire, so that they are emphatically in favor of the passage of rules which will protect against a life hazard. They do not want to make them paramount, they are willing to receive suggestions, and in connection with this rule, 13-a, which refers to the grounding of the secondary alternating circuit currents, it will be discussed a little later and is an example to show their willingness to protect against accidents.

In regard to the wiring against gas-pipes, he thought that was a question of detail.

The report of the committee on standard rules for electrical construction and operation, by Ernest H. Davis, Williamsport, Pa., chairman, was considered with the report of the committee on the fire hazard of electricity, which was presented by C. E. Skinner, Pittsburg, chairman.

The report makes a complete analysis of the causes of and losses through fires, with averages and percentages, in the boroughs of Manhattan and the Bronx, New York city. The fire losses from electricity for the year 1906 have been largely increased, owing to a single loss of $200,000 due to the destruction of a large car-barn in Manhattan. Statistics are also given for Boston, Mass., Los Angeles, Cal., and for various states throughout the Union. A detailed examination is made of replies from various states to a series of questions sent to both central-station managers and fire underwriters concerning the fire hazard and the methods which should be adopted for improving it. The committee recommends that the association take action looking to systematic and uniform inspection throughout the country, this inspection to be based on the National Electrical Code. It recommends that each member company appoint an individual, part of whose duties it shall be to follow up all fires in the company's territory that may be attributed to electrical causes, to see that the exact facts are ascertained and published. The committee also recommends that it shall be the duty of the secretary's office to collect and distribute information relative to the fire hazard situation.

The meeting then resolved into executive session and heard the reports of the committees to revise the constitution and by-laws, Samuel Scovil, Cleveland, and membership dues, W. H. Gardiner, New York.

E. H. Davis, Geo. B. Stetson and Paul Spencer were appointed a committee on resolutions.

L. A. Ferguson, Samuel Scovil and W. W. Freeman were appointed a committee on the president's address.

The meeting then adjourned until Tuesday evening.

At the Tuesday evening session the report of the Committee on Electric Light Accounting was presented by H. M. Edwards, chairman, and George Whitefield Betts, Jr., presented his paper on "Legal Justification for Differential Rates."

The paper by Frank Conrad, entitled

"Recent Developments in Mercury Rectifiers," was also presented.

The rectifier, in its usual form, consists of a glass bulb containing two positive electrodes or anodes, and one negative electrode or cathode. This bulb is exhausted to a high degree of vacuum, and sealed. The two positive electrodes are connected to the terminals of the transformer supplying the alternating current, the connections for the direct-current supply being made between the negative electrode of the bulb and the middle point of the transformer winding. The general design of the bulb and auxiliary apparatus is determined usually by the requirements of the direct-current circuit that is to be supplied. This, in most cases, can be classed under two heads, namely, supply of low voltage approximately constant potential for charging isolated storage battery plants, and a high-voltage constant-current circuit for supply of series arc lamps. Outfits classed under the first head are usually operated from a low-voltage supply, and an autotransformer is used to transform this voltage to that required by the bulb. The efficiency of an outfit of this character is high compared with that of a small motor-generator set. It is determined mostly by the voltage of the direct-current circuit, as the voltage loss in the bulb is practically constant, irrespective of the total voltage of the circuit or the current delivered. The power-factor of the outfit, when used without the adjusting reactance in the alternating-current circuit, would be about ninety per cent. When used with a reactance it will be lower. From the standpoint of the central-station man, the most important development of the rectifier is that for the operation of constant-current, direct-current arc lamps. For the supply of constant-current circuits it is necessary that the function of a regulator be combined with that of a rectifier, and the obvious method is to use a regulator of the same type as that employed in connection with alternating-current lamps, and convert the current delivered by this regulator into a direct current.

There was a brief discussion on each of these topics, and the meeting adjourned at about 11 o'clock.

WEDNESDAY MORNING SESSION.

President Williams called the meeting to order at ten o'clock, the first paper, by G. M. Little, of Pittsburg, entitled "New Developments in Arc Lamps and High-Efficiency Electrodes," being read.

This paper describes the action of the metallic arc, with particular reference to the magnetite arc lamp, giving some details of the method of construction upon which the success of this lamp depends.

The paper entitled "Indefinite Candle-Power Ratings in Municipal Contracts," by E. L. Elliott, of New York, was read.

Attention is directed to the indefiniteness which the present use of terms gives to contracts involving a supply of light. There are in existence what are popularly supposed to be lighting contracts involving the payment of many millions of dollars annually, which, if carefully scrutinized, will be found not to be lighting contracts at all in the strict sense of the term, but for the sale of electric current in connection with the use of certain apparatus generating light by means of the current furnished. It may be broadly stated that light has never been sold as a commodity, as payments have never been based upon the measurement of the actual quantity of light furnished. As an example of the difficulty which may arise from this uncertainty, the case of Colorado Springs, Col., is described. Here the contract called for arc lamps of standard 2,000 candle-power. It was found that the actual amount of light given was nearer 300 candle-power, and the city contended that the contract was not being lived up to. The controversy was settled by a board of arbitrators in favor of the lighting company, it being shown that the 2,000-candle-power rating was nominal, and did not pretend to indicate the actual amount of light furnished by the lamps. The author holds that the use of the single item, "candle-power," as a basis for lighting contracts is objectionable from any point of view. To the citizen it either conveys no meaning at all, or is assumed to be the degree and effectiveness of the illumination of the streets, which is very far from the truth. To the party furnishing the light, it may refer to a certain type of lamp, or to intensity in a specified direction, or to the total flux of light, or to the lower hemispherical flux. The use of a term in the contract upon which payments are to be based which even to those familiar with the technology of the subject, may have any one of a half-dozen meanings, and to the layman, either no meaning at all, or a meaning apart from any of those understood by the engineer, is manifestly opposed to the requisites of definiteness, which should be the first aim in the wording of all contracts. If the term "candle-power" is to be used at all, its exact meaning as used in the particular contract should be carefully defined. It is suggested that illumination measured in foot-candles is more scientifically exact and generally satisfactory as a basis for a contract. The watt consumption of a lamp should never be used as a measure of its light-giving power, and every lighting contract should be examined and approved by a competent illuminating engineer.

Discussion on this paper was deferred until the reading of the paper by Mr. Floy on a kindred subject.

Dr. S. W. Stratton, director of the National Bureau of Standards, was introduced, and explained some of the functions of the bureau, and extended an invitation to the members to visit the various departments.

The paper entitled "Indefinite Obligations in Municipal Contracts," by Henry Floy, of New York, was then presented.

The author calls attention to the danger lying in indefinitely drawn contracts. Even with good will and good faith, so necessary to the proper carrying out of a contract, both parties thereto should definitely understand its obligations. The cause of controversy between corporations and municipalities will usually be found to be either a lax appreciation by the corporations of the full obligations to the municipality or to an indefinite understanding by the municipalities of the obligations undertaken by the corporations. The necessity is pointed out for special care in this matter in all specifications proposed by the association. It concludes that before entering into a contract with a municipality, a company should come to a clear understanding with the municipality as to exactly what the contract is to cover, and should see that the wording of the contract is exact, with a tendency toward repetition rather than brevity and omission. It is advisable to maintain good feeling throughout the life of the contract, even at some sacrifice of profit, and daily station records should be kept, so that the company will, at any time, be prepared to go to court before arbitrators to prove its case.

This paper touched so directly upon the report of the Committee to Consider Specifications on Street Lighting that it was thought well to have the report read at this time. In connection with this report and its presentation, Dr. Kennelley, of Harvard University, took the chair, and Dudley Farrand, chairman of the above committee, presented the report.

This committee has prepared specifications to cover ordinary conditions of street lighting, and recommends that these replace the previous specifications which were presented to the association at the meeting of 1894. The specifications are given in the report.

Dr. C. P. Steinmetz opened the discussion on the report. He said that for nearly twenty years the electric lighting industry has been almost in a dreamless sleep. Incandescent lamp and the carbon arc lamp held undisputed sway, and while a gradual slow advance was made no radical advance occurred except perhaps the replacement of the open arc by the enclosed arc, and of the direct current by the alternating current, and both, as regards efficiency, probably were rather negative; that is, efficiency was sacrificed to convenience and reliability and steadiness. In the last few years we have experienced an enormously rapid advance. In the incandescent lamp field we have seen appear the Nernst lamp, the tantalum, the tungsten lamp, and gradually the efficiency of the incandescent lamp rose far beyond that of the arc lamp of old. In the field of arc lighting, improvements have also taken place. In Europe the flaming carbon lamp was developed by impregnating the carbons with some chemicals; the amount of light for a given amount of power was increased manyfold, so that efficiencies unheard of before were realized.

Now, when we deal with the sources of light there are really three questions of importance: the first is efficiency, the second is the size of unit and the third is color. What we desire is the highest possible efficency. The various lamps stand in groups by themselves. For efficiencies of a fraction of a watt per candle-power, we have the flaming carbon lamp, the magnetite lamp and the mercury lamp. The next lamp stands by itself with an efficiency of a little less than one watt per candle-power, and that is the tungsten filament. Then, with a gradually decreasing scale of efficiency, we meet in succession the old carbon arc lamp, the tantalum lamp, the Gem filament lamp, the Moore tube, the Nernst lamp and the old incandescent lamp. High efficiency is not the only thing; we may get in a flaming carbon lamp an efficiency of a quarter of a watt per candle-power, but we get that only with a candle-power of thousands, which would not be available for many uses, where we need sixteen candle-power or fifty candle-power. The size of the unit is of importance also. Arc lights are inherently at their best efficiency in units of many hundreds or thousands of candle-power. The incandescents are smaller units of light and there is one curious feature, this higher-efficiency incandescent lamp, of larger size, the tungsten lamp, as it appears to us, is a seventy-candle-power lamp, while the old carbon filament was a sixteen-candle-power lamp. If we look into it we will see that the power consumed per lamp has remained about the same. The sixteen-candle-power fifty-watt incandescent lamp, like the metallized-filament lamp, still uses fifty watts, but gives thirty candle-power. The tantalum with fifty watts gives from twenty-five to forty candle-power, with some fifty candle-power from the tungsten. What has been done has been the increase of light given for the same power.

V. R. Lansingh said that considering only the vertical distribution of light is all right when lighting a square where what was wanted was to throw the light in all directions, but in street lighting we are primarily interested in throwing the light up and down the street, and not in horizontal directions, as we do not care generally to light the fronts of houses or light vacant lots along the side of the street, and it seemed to him, therefore, that we should take into account not only the redistribution of vertical light but also the horizontal. It is no doubt possible to build reflectors or globes which would throw practically double the amount of light up and down the street as would be given without such globes or reflectors, and therefore in specifying street lighting if the lamps were not equipped with such globes or reflectors we might need twice the amount of light that we would if they were so equipped. It seems to him that in specifying proper units for street lighting that we should take into account not only the redistribution of the vertical light but also the horizontal.

W. D'A. Ryan explained, by using a series of charts, the practicability of the committee's recommendations. He also warmly defended the alternating-current arc lamp, but said care should be taken in substituting so that an illumination should be produced by the alternating-current arc equal to that of the direct-current arc which it replaced, outside of any consideration of improved operating conditions.

F. W. Willcox, Dr. E. P. Hyde, Alex Dow and Dr. Edward Weston contributed to the discussion of the report.

A. J. De Camp suggested that the committee be continued and report more fully next year.

L. A. Ferguson thought, however, that immediate action was necessary and moved that the committee conclude its work and, subject to the approval of the executive committee, issue its report in a final condition to the members during the year. This motion was finally carried.

Following the discussion on this report, Samuel Scovil offered a resolution to the effect that the 450-watt test recommended in 1894 was a proper test for the older forms of arc lamps and the present carbon arcs, but that it was not a proper test for the newer forms of lamps, such as the flaming arcs, the mercury vapor tube lamp, or the Moore vacuum tube lamp.

The paper by C. D. Wood, entitled "Electric Heating Without Special Concessions from the Central Stations," was then presented in abstract.

The author states that the number of devices in use has increased 100 per cent during the past year. This is the result of the agitation which has been going on, and the earnest endeavor of the manufacturers to induce the seller of current to put out new heating devices. The paper calls attention to the various opportunities, and shows illustrations of applications of electrically heated apparatus in various classes of industry. In discussing the installation of heating and cooking devices in residences, the author states that the greatest difficulty in residential work has been the absence of adequate carrying capacity in risers, special circuits and available extra circuits. The customer will often be willing to pay the first cost of the device, he will accept the consumption figures, but he will flatly refuse to stand the expense of the extra wiring.

There being no discussion, the meeting adjourned until 8 P. M.

On Wednesday evening the session was called to order promptly at 8 o'clock, and Dr. C. P. Steinmetz presented his classical lecture, "Lightning and Lightning Protection." Several papers announced for the morning session were then taken up.

On Thursday morning the report of the Freight Classification Committee was presented by Ernest H. Davis, and the remaining technical papers of the convention were taken up.

Friday was devoted to commercial or new-business day, a number of valuable papers being presented, followed by brief discussions.

The automobile tours were greatly enjoyed by the ladies present, and the recep-

tion by President Roosevelt at the White House was attended by nearly 900 of the members. General Harries presented President Arthur Williams to Mr. Roosevelt, and Secretary Eglin and Vice-President Dudley Farrand were presented in turn. The members attending the reception then formed in a long line, and each greeted the chief executive of the country. On Tuesday evening the ladies attended the performance of "Trilby" at the Columbia Theatre.

A special feature of the Wednesday entertainment was the exhibition cavalry and field artillery drill at Fort Meyer. This was attended by about a thousand of the members and guests. At 9.30 in the evening an informal dance was held in the small ball-room of the New Willard.

On Thursday afternoon a boat trip was made to Mount Vernon, and in the evening a car ride was taken to Cabin John Bridge.

Convention Notes.

THE exhibition of the associate companies was held on the tenth floor of the New Willard Hotel. On the evening of Monday, June 3, at eight o'clock, the exhibit was thrown open to the visitors. Twin cable streamers, intertwined with evergreen, hung in festoons from the roof and chandeliers, studded with thousands of colored lamps. The wall fixtures were decorated with incandescents concealed in colored shields. The booths, of uniform style and color, were very small and compact, but, as large pieces of apparatus were very generally eliminated, the congestion was hardly noticeable.

The W. J. Barr Electric Manufacturing Company, Cleveland, Ohio, showed a line of chafing dishes, percolators, stoves, broilers, griddles, glue-pot heaters, sealing-wax heaters, heating pads and flat-irons. Represented by W. J. Barr, president, and A. F. Brown, eastern sales agent.

The Dearborn Drug and Chemical Works, Chicago, Ill., had a pleasant reception booth, exhibiting views of its laboratories and offices, and giving away a sample bottle of perfume of its own manufacture as a souvenir. Represented by W. B. McVicker, second vice-president and eastern manager; H. G. McConnaughy, New Jersey manager.

Dossert & Company, Incorporated, exhibited a line of solderless connectors, showing some new types of lug connectors. This company announced that these connectors have been approved by the fire underwriters, and that Rule 14 of the Code had been changed to allow their use. Represented by H. B. Logan, president; J. J. Dossert and E. A. Dossert.

The Fort Wayne Electric Works, Fort Wayne, Ind., exhibited transformers, type K single-phase and multiphase wattmeters and prepayment meters, arc lamps and arc-lamp regulators, fan motors and motor applications, such as buffing wheels, hand drills, etc. At this booth was shown the vibrating machines of the Shelton Electrical Company, using "Wood" type GA and GD motors. Represented by F. S. Hunting, sales manager; A. A. Serva, assistant sales manager; T. L. Sturgeon, C. A. Woolsey, E. H. Porter, A. A. Brown, C. A. Thomas, Philadelphia office; J. B. H. Van Zandt, Charlotte, N. C.; J. C. Lott manager, New York office; J. C. Moulton, New York office; H. W. Smith, manager Boston office; A. G. Lucas, Fort Wayne, Ind.

The Franklin Electric Manufacturing Company, Hartford, Ct., exhibited its Gem and tantalum lamps, equipped with Holophane reflectors of the bowl, concentrating and diffusing types. A feature of this exhibit was an electric sign, a facsimile of the "Novi" label, made up of 704 blue and white miniature lamps. Represented by P. S. Klees, C. N. Thorpe, G. O. Curtis, C. Leonard, T. G. Truitt.

The Jandus Electric Company, Cleveland, Ohio, showed an alternating-current, street series, twenty-five-light system complete, with step-up transformers, reactance regulator, controlling panel, etc., ceiling and column "Gyrofans," both alternating and direct current, desk fans, the new Jandus pendant pull-switch, and the new absolute cutout. A full line of the figure 80 interchangeable arc lamps was shown. This lamp is so designed that with a common structure a lamp for any service may be instantly assembled. The feature of interchangeability has been so carried out that any system may be changed over with a minimum loss of parts. A feature of this exhibit was a life test carried out on a 110-volt multiple, direct-current arc lamp, having connected in circuit a voltmeter for the line voltage, a voltmeter for the arc voltage, an indicating ammeter, and a recording ammeter. These arc lamps were fitted with the company's K-7 fluted-steel, fire-enameled street reflector. Represented by L. J. Costa, C. L. Eshleman, H. D. Enderiss, J. P. Manypenny.

The H. W. Johns-Manville Company, New York, N. Y., exhibited the "Victor" combination meter in automobile, portable and switchboard types, "Noark" subway and service boxes of one, two and three-pole construction, and 250, 600 and 2,500-volt capacity. The company distributed samples of J.-M. friction tape. Another feature of this exhibit was the "Transite" asbestos fireproof doors for high-tension transformers and switches. Represented by J. W. Perry, manager electrical department; R. R. Braggins, manager electrical department, Cleveland; H. M. Frantz, manager electrical department, Chicago; H. H. Voorhis, manager electrical department, Philadelphia; S. G. Meek, New York; A. J. Saylor, Milwaukee; W. F. Little, electrical engineer, New York; G. U. G. Holman, manager electrical department, Boston; E. F. Quirke, New York; R. C. Buell, assistant secretary, Johns-Pratt Company; R. C. Cole, electrical engineer, Johns-Pratt Company; C. T. Bishop, government department, New York.

One of the most interesting and important exhibits was that of the National Electric Lamp Association. This association is maintained by the Banner Electric Company, Youngstown, Ohio; the Brilliant Electric Company, Cleveland, Ohio; Bryan-Marsh Company, Chicago, Ill.; the Buckeye Electric Company, Cleveland, Ohio; the Colonial Electric Company, Warren, Ohio; the Columbia Incandescent Lamp Company, St. Louis, Mo.; Economical Electric Lamp Company, New York, N. Y.; the Fostoria Incandescent Lamp Company, Fostoria, Ohio; the General Incandescent Lamp Company, Cleveland, Ohio; New York & Ohio Company, Warren, Ohio; the Shelby Electric Company, Shelby, Ohio; the Standard Electrical Manufacturing Company, Niles, Ohio; the Sterling Electrical Manufacturing Company, Warren, Ohio; the Sunbeam Incandescent Lamp Company, Chicago and New York; the Sunbeam Incandescent Lamp Company of Canada, Ltd., Toronto, Ontario; the Warren Electric and Specialty Company, Warren, Ohio. The largest display of street series tungsten lamps ever seen were displayed here, operating at forty candle-power, 5.5 amperes, 1.33 watts. A cabinet of miniature tantalum and tungsten lamps for two to twenty-eight volts, operating at one-half to eight candle-power and 1.25 watts for the tungsten and two watts for the tantalum were shown. There was also a rheostat showing the comparative behavior of tantalum and old-style carbon-filament lamps on voltage change. In addition to this there were Gem metallized filament lamps and forty and eight-candle-power tantalums, and eighty-watt,

100-candle-power tungsten lamps with five filaments in series. Another feature was a cabinet showing the values of various incandescent lamps with differently colored material. The following representatives were present: Engineering department—S. E. Doane, chief; W. M. Skiff and G. S. Merrill; Banner, N. L. Norris; Brilliant, E. J. Kulas; Bryan-Marsh, G. G. Lockwood and E. H. Haughton; Buckeye, L. P. Sawyer; Colonial, Colonel E. E. Nash; Columbia, Arthur Garrison; Economical, L. Lobenthal; Fostoria, H. H. Geary; General Incandescent, H. C. Rice; Shelby, J. C. Fish; Sterling, Wm. Coale; Sunbeam, H. B. Van Zwohl and A. S. Terry; H. M. Van Zwohl, acting secretary of the association.

The Oneida Community, Limited, Oneida, N. Y., exhibited a full line of arc-lamp suspension chains and sign suspension chains. Represented by J. N. Milnes and V. W. Lee.

The Pettingell-Andrews Company, Boston, Mass., made a specialty of its remote-control switches. Represented by W. J. Keenan, sales manager, and G. E. Palmer, electrical engineer.

The Philadelphia Electrical and Manufacturing Company, Philadelphia, Pa., featured a model manhole section showing the application of its metallic wrappers, sealing plugs, fuse and junction boxes and service-connecting plugs. Represented by C. L. Bundy and R. H. Manwaring.

The Pittsburg Transformer Company, Pittsburg, Pa., exhibited a standard line of light and power transformers in one, ten and fifteen-kilowatt sizes; two power-transmission transformers of fifty and 100-kilowatt sizes, designed for 22,000 volts. The company distributed a special edition of its "pretty-girl" calendar for June, and a fine brand of Pittsburg stogies as souvenirs. Assisting this company was George A. Rumsey, Jr., of the Rumsey Electric Company, Limited, of Philadelphia, for the last nine years handling the Pittsburg transformer in the East. The Pittsburg company was represented by F. C. Sutter and H. G. Steele.

The Standard Paint Company, New York, N. Y., exhibited a model house covered with "Ruberoid" roofing. The floor of the booth was covered with "Ruberoid" flooring. There was also exhibited a line of P. & B. insulating compounds, armature and field-coil varnish, and P. & B. insulating tape. Represented by J. M. Richards, general sales manager; C. E. Smith, manager paint and electrical department, and J. G. Satterthwait, manager Philadelphia branch.

The Southern Exchange Company, New York, N. Y., exhibited a line of long-leaf yellow pine for poles and cross-arms, southern white cedar for poles and photographs of its mills and yards throughout the South. Represented by E. G. Chamberlin, president, and Walter E. Mitchell, sales manager.

The Wagner Electric Manufacturing Company, St. Louis, Mo., exhibited its single-phase variable-speed fan and other single-phase variable-speed motors with autotransformer control, and a line of switchboard and portable indicating meters. Represented by W. A. Layman, general manager; Walter Robbins, assistant general manager; E. W. Goldschmidt, district manager, New York; A. W. Wyckoff, Pittsburg; Brooks Faxon, Boston; C. W. Henry, Atlanta; J. H. Jewett, Chicago; John Mustard, Philadelphia.

The Western Electric Company, Chicago, Ill., exhibited a line of direct and alternating-current fan motors and alternating and direct-current arc lamps, including the new "Hawthorne" short arc lamp for suspension from low ceilings. The company also exhibited a line of Vulcan soldering irons. Souvenirs in the shape of a map of Washington, D. C., in colors, and a celluloid novelty in the form of a short arc lamp, were given away. Represented by H. M. Post, W. L. Stockton, power-apparatus salesman; E. W. Rockafellow, general supply sales manager; Mr. Keefer, assistant manager of power-apparatus sales; C. A. S. Howlett, Chicago, power-apparatus sales manager; W. Templin, supply salesman.

The American Electric Heater Company, Detroit, Mich., opened a booth for the reception of visitors and was represented by B. H. Scranton, president, and Robert Kuhn, secretary.

The Allis-Chalmers Company, Milwaukee, Wis., exhibited photographs of its works and products, and descriptive bulletins and catalogues. Represented by W. S. Heger, assistant to president; Maurice Thomas, manager Atlanta office; J. C. M. Lucas, manager Baltimore office; Mr. Nicholson, manager Philadelphia office; A. P. Peck, New York; H. W. Rowley, New York; E. T. Pardee, Boston; J. R. Jeffrey, R. B. Williamson, B. Frankenfield, E. St. John Chilton, B. A. Berriam, James Gardiner, A. H. Whiteside.

Harold P. Brown made a specialty of "contact alloys." Represented by T. H. Ely and J. Maxwell Coote.

The American Instrument Company, Philadelphia, called attention to its line of "American" measuring instruments and shunts. A large model of the new long-scale switchboard meter was shown. Represented by James G. Biddle and A. O. Benecke.

The Curtis Advertising Company, Detroit, Mich., exhibited samples of advertising for central stations. Represented by F. A. Curtis, president; C. A. Parker, C. H. Johnston and F. C. Matthews.

The Electric Storage Battery Company, Philadelphia, Pa., exhibited recently developed automatic cell filling apparatus; compensating, recording and signaling hydrometers, Exide batteries for commercial vehicles, end cell switch and central station types of chloride accumulators. Represented by Charles Blizard, E. L. Reynolds, Albert Taylor and A. H. Ackerman.

The Federal Electric Company, Chicago, Ill., showed a fine line of electric signs, operating a flasher for turning on and off the lamps, making a very effective demonstration. Represented by W. J. Norton and R. B. Francis.

The Crocker-Wheeler Company, Ampere, N. J., exhibited a fine lot of photographs showing typical installations of C.-W. apparatus, and distributed souvenir postal cards. Represented by Rodman Gilder, W. C. Appleton, G. W. Johnston, R. C. Randolph, Jr., H. Lomas.

The Fibre Conduit Company, Orangeburg, N. Y., showed samples of its conduits for underground and station service in straight lengths, bends and fittings. Represented by W. K. Sparrow, F. A. Curtis and S. G. Thompson.

The General Electric Company, Schenectady, N. Y., made a fine display of Gem, tantalum and tungsten lamps, including the new street series tungsten, forty-candle-power, fifty-three-watt lamps. There was also an elaborate display of heating and cooking apparatus, and several forms of alternating and direct-current fans. Represented by J. R. Lovejoy, vice-president and sales manager; C. D. Haskins, manager lighting department; W. L. R. Emmet, A. D. Page, F. W. Willcox, F. H. Gale, P. D. Waggoner, H. J. Buddy, Philadelphia; C. B. Burleigh, Boston; Theodore Beram, A. D. Babson, George L. Thompson, J. P. Judge, A. F. Giles, W. J. Hanly, J. Scribner, S. F. Dibble, F. G. Vaughn.

John L. Gleason exhibited a line of "Fancleve" specialties and was present to explain the good points of this system.

The Metropolitan Engineering Company, New York, N. Y., exhibited samples of its sign illuminations. Represented by Benjamin Wall.

The M. O. Publishing Bureau was represented by A. H. Grant and Glen Marston.

The National Electrical Supply Company, Washington, D. C., exhibited an interesting line of specialties. Represented by E. C. Grant, I. L. Townsend and A. Dunlop.

The New York Beck Lamp Company, New York, N. Y., made a feature of two lamps operating in series on 110 volts, 60 cycles, without any starting or controlling mechanism, and consisting only of the frame, carbons, guide rods and the Beck copper shoe support for the lower end of the carbon, demonstrating the Beck gravity feed. There were also several alternating-current lamps which operate on any frequency between twenty-five and 140 cycles, the only change necessary is to adjust a resistance within the lamp to compensate for the change in impedance of the magnet coils. An order for these lamps to operate in multiple through individual transformers on a 1,000-volt circuit has just been delivered to the government at Indian Head. A line of direct-current Beck flaming arc lamps was also shown. Another feature of this exhibit was a line of HCK specialties, including table lamps and portables, instantaneous continuous-flow water-heater, and automatic time switch. The latter is unique, as it is made to fit inside the standard arc

lamp pole base, and the bearings, pinions and gears are made entirely of non-corrosive metal, German silver and phosphor bronze being used throughout. The clock unwinds by gravity and will run for a week without rewinding. The company made a special offer for the introduction of these specialties which attracted a great deal of attention. Represented by William Ottman, president, H. B. Coles and Carl Loeffler, of the New York Beck Lamp Company; and J. H. Hallberg, general manager of the Beck Flaming Arc Lamp Company.

The Pope Motor Car Company, Waverley department, Indianapolis, Ind., made an exhibit of a General Electric mercury rectifier set and a case of Exide batteries, forming a typical garage for electric vehicles. Represented by Herbert H. Rice, Henry Goodman and W. C. Downey.

The Simplex Electric Heating Company, Cambridgeport, Mass., exhibited an elaborate line of heating and cooking apparatus. Represented by James I. Ayer, Roger Williams, P. H. Howard and C. A. Flint.

The Standard Vitrified Conduit Company, New York, N. Y., exhibited samples of single and multiple duct. Represented by B. S. Barnard.

The Telelectric Music Company demonstrated its electrical piano-player. Represented by John F. Waters and I. Dillingham.

The Weston Electrical Instrument Company, Waverley Park, Newark, N. J., made a fine showing under the direction of Charles P. Frey and Stanley Brown, presenting eleven groups of entirely new lines of switchboard and portable electrical measuring instruments. Four of these groups comprised entirely new forms of alternating-current switchboard voltmeters and ammeters, and three others groups comprised alternating-current portable instruments. In addition to a fine display of measuring instruments, a number of remarkable laboratory instruments were shown.

The C. W. Lee Company, Newark, N. J., published a *Convention Daily,* and entertained its guests through its representatives, C. W. Lee and F. B. Rae, Jr.

G. M. Gest, the well-known engineer and contractor of New York and Cincinnati, was represented by W. T. Jackson, Cincinnati commercial engineer. A number of striking photographs showing conduit installations in various parts of the world were exhibited.

The Sheldon School was represented by J. D. Kenyon and Francis Raymond.

J. G. White & Company, New York, N. Y., opened reception headquarters.

The Westinghouse Companies' exhibit represented the product of the Westinghouse Machine Company, Westinghouse Electric and Manufacturing Company, Westinghouse Lamp Company and the Nernst Lamp Company.

The arrangement was very tasteful and many lines of new apparatus were on view. Direct-current series metallic flame-arc lamps were shown for the first time in operation on the Fourteenth street side of the New Willard Hotel, eight of the lamps burning in series, each taking fifty volts and four amperes. The current for this purpose was taken from the alternating-current street mains at 220 volts, sixty cycles. A regulating transformer stepped up the voltage and regulated the current supplied, and a mercury rectifier of Westinghouse make changed the current from alternating to direct. This metallic flame arc lamp requires one-half of the electrical energy consumed by the ordinary carbon lamp, and is particularly adapted to such lighting, since the rays of light are emitted from the flame in a horizontal direction. The Westinghouse Lamp Company showed a number of high-efficiency metallized filament lamps ranging in candle-power from twenty to fifty, at 110 volts, and a number of tungsten lamps in a cluster suspended from the ceiling. The Westinghouse Electric and Manufacturing Company displayed on a table a very complete line of instruments, both for switchboard mounting and portable use, including the company's new graphic recording ammeters, voltmeters and wattmeters, the new Westinghouse type "CC" carbon-break circuit-breaker, as well as the small-capacity type "F" circuit-breaker for motor service and Westinghouse fan motors in both twelve and sixteen-inch sizes for alternating-current and direct-currents. There were also shown many types of enclosed carbon arc lamps, including series, multiple alternating-current and direct-current, 110 and 220-volt, in a variety of finishes, and in addition a new lamp which has been developed for 250 volts direct-current multiple, which is strictly fireproof and, it is said, will not burn out under the most severe conditions of short-circuits. The Nernst Lamp Company showed the development of a new single-glower unit brought out to fill the gap that has heretofore existed between the one and two-glower units, the one-glower unit not giving sufficient light for certain classes of lighting, and the two-glower unit giving more light than necessary. This lamp takes 110 watts, emitting 115 candle-power in a downward direction, and is equipped with a four-inch clear ball. The Nernst Lamp Company also exhibited the multiple-glower type of direct-current lamps. In the company's section of the Westinghouse booth were shown two three-glower ceiling fixtures of art glass; one three-glower ceiling fixture with nine-inch Holophane hemisphere; one three-glower ceiling fixture equipped with an opalescent hemisphere, and one six-glower ceiling fixture equipped with a twelve-inch Holophane hemisphere, and several three-glower direct-current lamps, single-glower Nernst lamps equipped with vertical glower. The Westinghouse Machine Company had on exhibition various-sized plates showing the form and construction of those used in their improved storage batteries. These plates are of the Planté type, both the positive and negative being of pure lead. The plates of the types shown are used in street-railway power plants for load regulation, lighting plants, railway-train lighting, railway signaling, etc. The Westinghouse Companies maintained headquarters on the ground floor of the New Willard Hotel, where beautiful enameled pins were distributed as souvenirs to the visitors. The following is a list of the representatives who were present: Westinghouse Electric and Manufacturing Company—W. M. McFarland, acting vice-president, G. M. Bates, J. W. Busch, Philip Clegg, A. M. Dudley, C. S. Gibbs, C. B. Humphrey, A. R. Laxton, S. L. Nicholson, E. T. Penrose, J. W. Schrantz, C. P. Billings, J. A. Brett, H. P. Davis, W. R. Dunbar, G. B. Griffin, R. B. Ingraham, George F. Leak, J. C. McQuiston, J. M. Nicholson, W. R. Pinckard, H. C. Stier, J. C. Warren, E. M. Bischoff, Samuel Chase, Mr. De Lancey, W. B. Everest, G. W. Hill, W. D. Jend, Irwin Lehman, F. D. Newbury, W. S. Rugg, H. Van Stagen; Westinghouse Machine Company—Edwin Yawger, L. A. Phillips, L. L. Brinsmade, Mr. Nicholson, H. Van Blarcom, J. R. Bibbins; Westinghouse Lamp Company—T. Whaling; Nernst Lamp Company—Max Harris, J. H. Gardiner, C. A. Barton, A. T. Holbrook, Otto Foell.

In addition to the representatives listed above, the following well-known men were among those present:

Arthur Williams, Dudley Farrand, Alex Dow, W. C. L. Eglin, George F. Porter, W. H. Blood, Jr., Samuel Scovil, A. J. De Camp, W. F. White, Charles L. Edgar, John Martin, Frank W. Frueauff, Charles R. Huntley, L. A. Ferguson, F M. Tait, W. F. Abley, Electric Goods Manufacturing Company; O. Baerwinkel, manager Excello Arc Lamp Company; Charles C. Baird, H. B. Camp Company; B. A. Behrend, Bullock Electric Manufacturing Company; T. H. Brady, Brady Manufacturing Company; J. W. Brooks, Pass & Seymour; C. A. Brown, Standard Underground Cable Company; John Campbell, Electrical Auditing Company; C. E. Corrigan, National Metal Molding Company; George T. Manson, general superintendent of the Okonite Company; F. C. Cosby, Standard Underground Cable Company; N. C. Cotabish, National Carbon Company; J. S. Crider, National Carbon Company; H. C. Cushing, the *Central Station;* John H. Dale, the Dale Company; C. W. Davis, Standard Underground Cable Company; D. D. Dickey, National Carbon Company; Henry L. Doherty; Stephen A. Douglas, American Vitrified Conduit Company; C. A. Bosch, Hugo Reisinger; H. B. Kirkland, National Metal Molding Company; Oscar Hoppe, American Circular Loom Company; Alexander Henderson, Sprague Electric Company; J. B. Olson and R. S. Satterlee, India Rubber and Gutta Percha Insulating Company; Richard S. Carrick and H. J. Jaeger, Tipless Lamp Company; R. K. Mickey and G. A. Nisbet, Novelty Incandescent Lamp Company; E. O. Lundin, Lundin Electric Manufacturing Company; J. S. Montague, George W. Ames,

W. S. Huntley, Buffalo General Electric Company; Basil Kodjbanoff, Benjamin Electric Manufacturing Company; H. L. Shippy, John A. Roebling's Sons Company; J. Robert Crouse; M. S. Seelman, Jr.: A. W. Sisson, D & W Fuse Company; Dr. Edward Weston, president Weston Electrical Instrument Company; J. S. Speer, president Speer Carbon Company; R. W. Lyle, president Standard Vitrified Conduit Company; J. H. Vaughan, manager H. C. Roberts Electric Supply Company; Frank J. Holmes, president and general manager Vulcan Electric Heating Company; R. W. Morgan, president Anchor Lamp Company; A. F. Hills and F. M. Hawkins, Crouse-Hinds Company.

Mr. Henry L. Shippy of the John A. Roebling's Sons Company delighted a number of his friends at the convention by presenting them with the latest cigar punch made in Paris. Each gift was accompanied by a detailed description in French, and perhaps that is one reason why some of the recipients have not yet become expert in the use of the gift, which is probably the best thing of the kind that was ever brought out.

Annual Report of the Niagara Falls Power Company.

The annual report of the Niagara Falls Power Company for the year 1906 shows gains for both net and gross earnings, as well as a substantial profit on operations.

The company's gross earnings for the last calendar year aggregated $1,370,308, compared with $1,201,480 for 1905, while the operating expenses and reserve, which latter item involved $100,000 amounted to $326,124, compared with $250,202 for the previous year. The net earnings, therefore, aggregated $1,044,184 compared with $951,258 for the preceding year. Other income amounted to $79,400 and the total income aggregated $1,123,584. Charges amounted to $786,897 compared with $1,048,947 for 1905, leaving a surplus for the year of $336,687 compared with $240,426 for the previous year. The profit and loss surplus aggregated $399,321 compared with $197,696 for 1905.

In commenting upon its charges, the company stated that the only charges recorded during 1906 were those incurred by the payment of the interest on its $4,980,000 of six per cent debentures of the Canadian collateral series A and B which was included in the cost of construction of the Canadian plant up to January 1, 1907, from which date the plant has been in commercial operation.

The combined balance sheet of the Niagara Falls Power Company and the Canadian Niagara Power Company which the former corporation owns and controls, showed total assets of $24,391,027 compared with $25,217,204 for 1905. Of the total assets $21,966,287 represented real estate, power-houses and other properties; $1,500,400 investment securities; $351,901, cash; $20,699, securities, bills and accounts receivable; $135,247, material and supplies, and $16,493, prepaid insurance.

In his report to the shareholders, D. O. Mills, president of the company, said:

"No additional construction work or installation of generating machinery have been authorized, the company's business must be confined for the present to the output of the plants as they now exist.

"By direct ownership and through stock control of the Canadian Niagara Power Company (only five shares of its capital stock being held by others), this company now has available for power generation on the American side of the Niagara river two complete plants with an aggregate capacity for an output of about 77,000 electrical horse-power, and a considerable reserve in power-generating machinery; an additional capacity of about 8,000 horse-power, of which, under leasehold rights, 7,500 hydraulic horse-power is now being generated in installations of tenant companies, and, on the Canadian side of the Niagara river a plant with installation for a continuous output of 40,000 electrical horse-power, one 10,000-horse-power generating unit being held in reserve. The cost of construction of this plant has included interest and park rentals to January 1, 1907, from which date it is treated as a commercial operation.

"From the commercial output of these plants, about 95,000 electrical horse-power and 7,500 hydraulic horse-power (leasehold hydraulic rights) now are yielding revenue. Contracts have been negotiated for the sale of additional amounts of electrical power deliverable upon the completion of the installation of the necessary apparatus. It is expected that before the close of 1907 substantially all of the combined output of these plants will become revenue producing.

"Firm contracts now in force covering long terms will require a considerable part of this power, the remainder, it is believed, will be absorbed quickly by the users of our power steadily increasing in number and requirements.

"The financial condition of the company never has appeared to be more satisfactory and promising.

"Subject to the approval of the stockholders the board of directors has voted to subscribe $20,000 toward the completion of a hospital at Niagara Falls, which is being promoted generally by the industries there as a needed relief for employés."

Swiss Electric Enterprise.

Consular Agent E. L. Phillips, of Chaux-de-Fonds, writes that the Swiss hydroelectric enterprise of the Lake of Brusio, in the Canton of the Grisons, the machines of which were first set in motion on March 10, is without doubt the most important upon the Continent. He describes the plant as follows:

"The water of the River Poschiavo is caught at the base of the Lake Poschiavo, which is used as a controller or regulator for the reservoir and conducted by a three-mile conduit into the reservoir 1,378 feet above the central station. From this reservoir the water is brought into the hydraulic station by means of five conduits fastened in the craggy rocks to a wall nearly vertical.

"The station now contains six groups of dynamos with, respectively, a force of 3,000 horse-power each. During this year there will be added four new groups, and in 1908 the two last, which will complete the installation and thereby enable the station to produce an energy of 36,000 horse-power. A portion of this will serve to the needs of the Valley of Poschiavo and for the future electric railway of the Bernina. The contractors will reserve for themselves 16,000 kilowatts, and this power will be distributed in the industrial region south of the lakes of Como and Majeur by the means of a cable 100 miles in length. This great undertaking is the property of a Swiss company, and its installations are due entirely to Swiss industry."

Breakdown on the Berlin Supply Network.

An unfortunate interruption of supply took place in Berlin on Wednesday night, May 8. The Markgrafenstrasse substation is fed with three-phase current at high pressure from the Moabit Electricity Works on the south bank of the Spree. At about 8 o'clock on the evening in question, a defect occurred on the main busbars of the Moabit station, from which the feeders to the Markgrafenstrasse substation are led. In order not to interrupt the supply to the consumers, which included the Royal Theatre, the neighboring stations in Mauerstrasse and Alte Jakobstrasse immediately took up the load. This, however, caused an overload on several cables, which occasioned a wholesale blowing of fuses. Naturally some time elapsed until new fuses could be placed in the numerous network-boxes, which are placed at all the important crossing points of the network, but when this had been done the supply of current was once more renewed over the whole district. The disturbance would have been confined to a much smaller area had it not been that the Markgrafenstrasse substation was at that time in course of reconstruction for the purpose of extension.—*Electrical Engineering London.*

MECHANICAL REFRIGERATION.

BY H. S. KNOWLTON.

An illustrated lecture on "Mechanical Refrigeration" was given in Frances Willard Hall on April 18 before the New-Business Department and invited guests of the Narragansett Electric Light Company, of Providence, R. I., by Eugene Carpenter, of Newton, Mass., electrical engineer, and Eastern representative of the Automatic Refrigerating Company. The subject was discussed broadly, with special reference to the interests of central station men at this season of the year, when approaching warm weather opens the way toward an enlargement of the connected load through the installation of motor-driven refrigerating machinery.

Mr. Carpenter pointed out that only four agents have been used enough in refrigeration to warrant mention—air, sulphur dioxide, carbon dioxide and anhydrous ammonia. Air is used in some systems, but the apparatus needs to be large and heavy for a given duty, making first costs excessive, and the system is very inefficient. Its use is confined practically to battleships. Sulphur dioxide is used to a very limited extent, and carbon dioxide has the advantage of being low in cost and quite efficient, but on account of the extreme pressure required for liquefaction (800 pounds to 1,200 pounds per square inch) much trouble is encountered with the packing, and leaks in the compressor and other parts of the system are continually causing trouble. Both these dioxides require the use of large amounts of brass and copper in the construction of the equipment, thus making the cost of this apparatus large. Anhydrous ammonia is used in probably ninety-nine per cent of all the plants in this country, because it is very efficient, reasonably cheap, has no damaging effect upon iron, lead and rubber, and requires only the pressure which many years of steam using have shown controllable.

There are two general systems of operating by the use of ammonia, absorption and compression. The former has some advantages where extremely low temperatures are required (below zero Fahrenheit), and both systems have their earnest advocates. Some companies make and install either system as the customer may elect. The commercial use is overwhelmingly in favor of the compression system. Statistics compiled very carefully about a year ago show that about ninety-four per cent of all the refrigeration in this country was performed by ammonia compression systems. There are two subdivisions to these systems, first, the direct-expansion, where the ammonia is used directly in the cooling coils; and, second, the brine system, where the direct expansion cools a brine made of salt or calcium chloride, which is forced through the cooling coils by means of secondary pumps. The direct method is slowly superseding the indirect or brine system because of its greater simplicity and higher economy.

On a test recently made of a small plant of the brine type it required forty-five per cent of the total power to circulate the brine and fifty-five per cent to operate the refrigerating apparatus. Undoubtedly this was an extreme case, but it is probable that a direct-expansion plant in this same place would have operated with fifty per cent of the power that was being used, for the reason that direct methods require no power in the circulation, and there is a loss in cooling the brine which would probably account for the saving of the difference between fifty-five and fifty per cent. This saving would be larger in small plants on account of the lower efficiency in all parts where the size is reduced.

Mr. Carpenter then discussed the fields of automatic, semi-automatic and non-automatic plants, emphasizing the value of the small automatic installation in connection with central station service. It is an important advantage that no attendance is required after such a plant has been erected and adjusted for a certain temperature, as the temperature will be self-maintained within a few degrees by the apparatus. In a general way it will pay to install an automatic plant where the maximum ice consumption is between 800 and 12,000 pounds in twenty-four hours. In an automatic plant 1.5 horse-power will produce in twenty-four hours an amount of refrigeration which will be represented by the melting of 800 pounds of ice; two horse-power represents 1,500 pounds of ice in twenty-four hours, and so on, up to fifteen horse-power, which is equivalent to nine tons of ice. The powers quoted will not actually make the ice specified, because the freezing tank must be kept cold as the ice is being frozen. In practice a well-designed plant will make about sixty per cent of its refrigerating capacity—that is, a plant which would perform the same amount of work as ten tons of ice would perform in melting, would make six tons of ice. As a general thing it will not pay from a financial standpoint to make ice in this latitude, but the results of refrigeration are quite different.

After discussing the superiority of mechanical refrigeration over the use of natural ice, including the elimination of labor, moisture, uncleanliness and the ability to produce and maintain lower temperatures, Mr. Carpenter quoted the following data from the operating costs of a five-horse-power automatic plant:

"Ice, in a well-insulated refrigerating space of 9,900 cubic feet (30′ × 33′ × 10′) can maintain a minimum temperature of forty-five degrees Fahrenheit in hot weather, and will cool about 7,800 pounds of food supplies during twenty-four hours. This service will require 5,200 pounds of ice each day, or seventy-eight tons a month, which at $3 a ton, will cost for each hot month about $234.

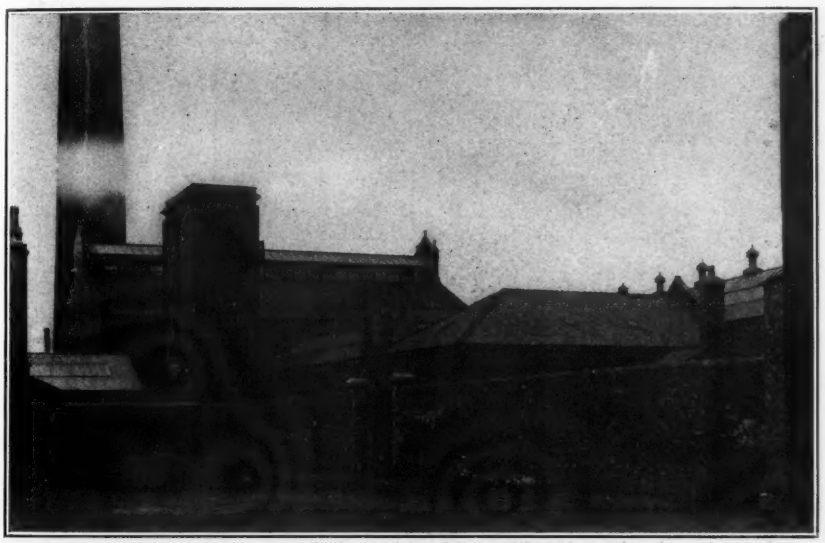
"Equivalent mechanical refrigeration, in the same space and under like conditions, will produce the same temperature of forty-five degrees, or will produce the usually desired cold storage temperature of thirty-six degrees, but in a smaller space of about 5,800 cubic feet (24′ × 27′ × 9′), and will cool about 8,100 pounds of food supplies per day. This work will require about 2,668 kilowatt-hours per month if operated continuously, and if the rate for electricity be four cents, the cost for each hot month, including the necessary cooling water ($11) will be $118.

"In other words, if the current and cooling water used during a hot July or August amounts to $118, the annual cost of operation should not exceed six times this amount, or $708. With ice, using 5,200 pounds per day at a cost of $234 for a hot month, the annual consumption would be about $1,404. This would show a saving of $696, and in about three years would be sufficient to pay for a five-horse-power automatic plant. In this comparison, an outside temperature of ninety degrees was assumed in calculating the refrigerating work for the cubic foot spaces mentioned, but less severe weather conditions will allow either an increase of cold storage duty or decrease in the running hours of the equipment per day. With the surrounding air at eighty degrees, about 11,700 pounds of supplies can be handled, or the equipment will operate twenty hours instead of twenty-four in cooling the 8,100 pounds previously mentioned. At seventy degrees the apparatus will run sixteen hours to cool the 8,100 pounds, or will handle a maximum of 17,500 pounds. Any less demand for refrigeration will reduce the running hours of the machinery per day, and hence the cost of power."

Preston, England, Electric Railway Run by City Refuse.

By Frank C. Perkins.

MUNICIPAL authorities throughout the world have been making a careful study during the past decade of the question of how best to deal with the refuse of their various communities and in these days of inventive genius and general development of labor-saving devices there has been wonderful municipal progress along these lines. The treatment of waste matter of cities and towns is now considered not wholly an expense, since the systematic and scientific burning of such refuse may make it a valuable asset in the generation of steam for the production of electric current for lighting the streets and public buildings, as well as for power for electric traction.



REFUSE DESTRUCTOR AND POWER PLANT, PRESTON, ENGLAND, MUNICIPAL ELECTRIC RAILWAY.

Such scientific treatment of waste refuse not only secures more healthful and sanitary conditions for the inhabitants but it may also be utilized in addition to the above service for supplying power for pumping water and sewage, while the cinders, as by-products, are utilized to advantage for pavement slabs, bricks, mortar and concrete.

More than two decades ago the city of Preston, England, installed its first refuse destructor consisting of a row of eight cells of the top-feed variety with natural draft, and this equipment served its purpose for several years when a second refuse destructor plant was installed consisting of twenty cells of the same kind, of the Manlove, Alliott and Fryer type. These were placed back-to-back and fitted with a Jones' fume cremator and the combined plants handled the city's refuse collection for another decade when it was found that it could no longer cope with the whole amount. The scavenging committee, being unwilling to resort to dumps, visited many operating destructor plants and paid particular attention to thorough cremation and methods of feeding.

A new refuse destructor was decided upon, of the front-feed type, the authorities maintaining that the top-feed isolated cells were responsible for the emission from the chimney of unconsumed vapors and for varying temperatures taking place in the furnace chambers. They were also impressed with the intense heat developed in the process of cremation, and with the power which it was possible to produce with the front-feed grate system of destructor.

The electrification of the Preston street railways was under consideration, and after conferences between the scavenging and tramway committees of that city it was decided to erect the stations for the two utilities side by side in order to utilize the steam power generated by the refuse destructor for the electric railway.

The destructor installation includes four Meldrum regenerative furnaces of the four-grate simplex type, each unit having a total grate area of 100 square feet. The plant is so arranged that any pair of the units can work together, and special attention was paid to cleanliness, convenience of operation and the saving of labor. As the carts of refuse arrive at the destructor plant they are backed against a long tipping sill and shoot their loads of refuse into four steel hoppers, each with a capacity of forty tons and thoroughly protected from the weather.

The refuse handled by this plant differs greatly from that of American cities, where the wet garbage and refuse is usually kept separate from the dry rubbish, such as paper, rags, ashes and wood. At Preston the refuse is of a miscellaneous character, consisting of dry and wet ashes with a sprinkling of excreta, offal, both animal and fish, together with condemned meat, game and poultry. About 20,000 tons of refuse is disposed of each year, or an average of fifty-five tons a day, and this does not include about twelve tons of fish offal and nine carcasses per week, including horses, cows, sheep, pigs and calves.

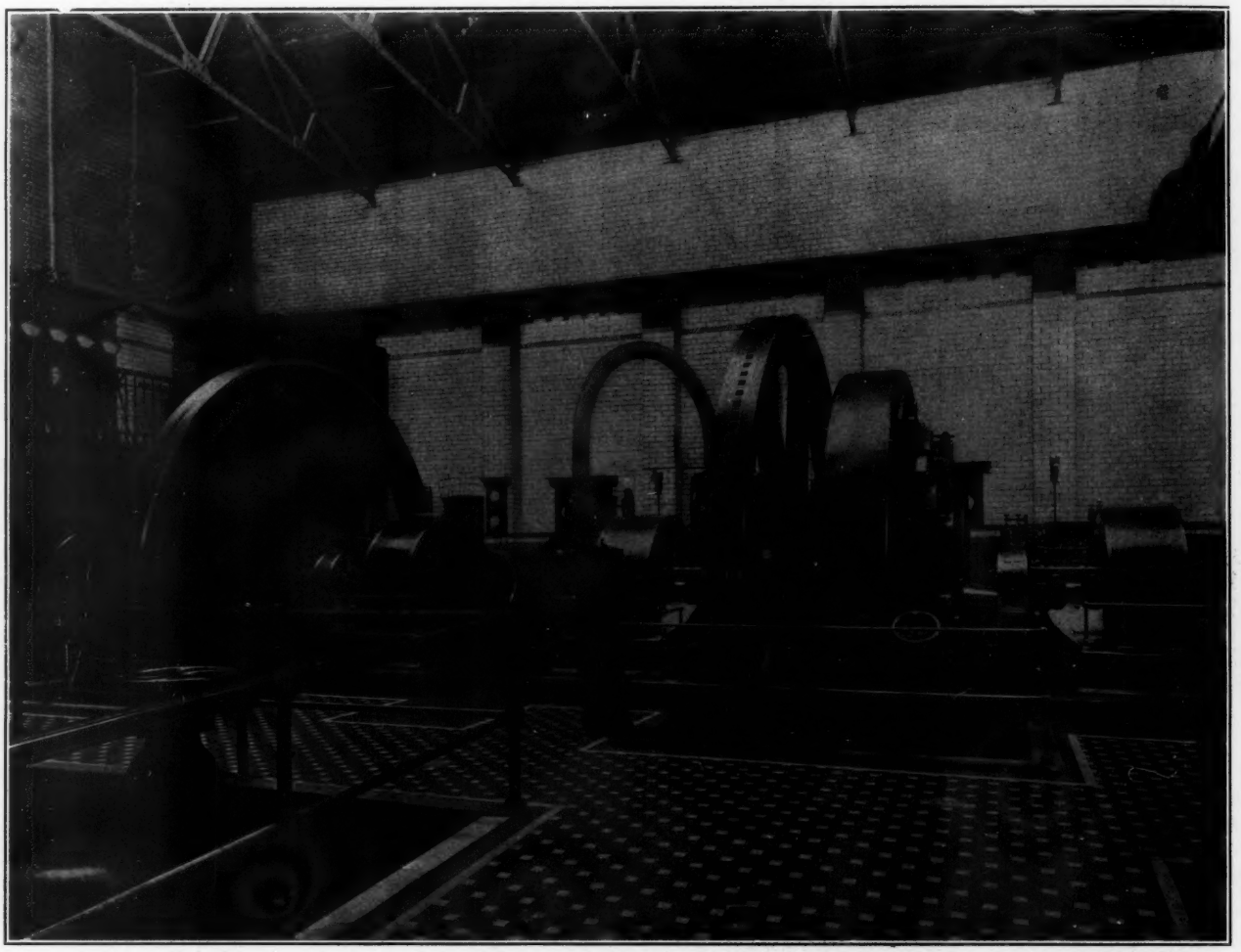
After passing the tipping platform and entering the destructor a wide corridor is noted, on one side of which is located the outlet of the hoppers and on the other side the furnaces. A stone sill is provided on which the refuse falls from the hoppers and from which it is charged by the firemen by hand through the front doors of the furnace, the fire being regulated to suit the material. The authorities at Preston advocate hand-feeding as the most satisfactory method, claiming that it combines efficiency and economy with a most perfect combustion of the material and an avoidance of all disagreeable odors. There is a large furnace chamber covered with one continuous arch with the simplex arrangement of grates; and on looking into the furnace it appears to be one length of fire bars with four door openings at the front, while it is in reality divided into four compartments by brick walls carrying inverted cast-iron tees with their edges level with the surface of the fire bars. Each compartment of the ash-pit contains separate forced draft accessories consisting of steam jet blowers. The gases of combustion traverse the furnace in the direction of its length. The burning gases leave at one end through an arched opening in the wall dividing the furnace and combustion chamber, most of the dust settling in the latter while the gases are

drawn to the boiler outlets lying at the further end of the chamber.

It is said that there is an absolute cremation of all noxious vapors, and it is difficult, most of the time, to ascertain from the appearance of the chimney whether the plant is in operation or not. It is held that this absolute cremation of the refuse is insured by the continual mixing of the gases in the furnace and combustion chamber while they are subjected to the radiant heat of the brick work maintained in an incandescent state. whole carcass is dealt with without handling. The Board of Agriculture requirements make it necessary that the destructor furnaces deal with whole carcasses of animals affected by such diseases as anthrax and glanders. It is unnecessary for a man to approach the opening in the furnace as the carcass is lifted directly from the cart by a traveling trolley operated at the platform end with a device for releasing the carcass below the opening of the furnace.

In the generating station there are four temperature maintained in this type of destructor furnaces is attributed to the fact that only one portion of the grate is being charged or being cleaned at a given time, the others being in an incandescent state, thus insuring the rapid ignition of each fresh charge. This even, high temperature insures a high evaporative duty in the boiler without in any way sacrificing the perfect destruction of the refuse without any nuisance whatever.

One of the interesting features of this Preston destructor plant is the regener-



Engine Room, Preston, England, Municipal Electric Railway.

Two of the four units are provided with an offal hearth and the gangway is at a convenient level from the tipping platform. This serves for unloading butcher's offal and fish, which is dumped down a brick-lined tube on a concave hearth, where it is exposed to the fire and the gases that are given off pass over the whole length of the fire-grate and are entirely consumed. In this way the carcass of a horse may be disposed of without in any way impeding the efficiency of the destructor, every part being cremated. The boilers of the Lancashire type. The gases after leaving the combustion chambers of the destructor house pass into these boilers. They are eight feet in diameter and thirty feet long and are designed for a working pressure of 200 pounds per square inch. Each is connected to the combustion chambers by means of three steel tubes lined with firebrick. It is said that the temperature is more constant than with a coal fire, and consequently there is less fluctuation in the steam pressure of the boiler. The constant high ator through which the gases pass after leaving the boiler. It consists of a nest of pipes, around which the air for combustion circulates as it is drawn into the ash-pit and is thus raised to a temperature of about 400 degrees Fahrenheit.

As a dust catcher, the regenerator is said to have proved very efficient, the dust which passes through the boiler flues being trapped and deposited beneath the tubes in the pit.

It is advantageous, where continuous power is necessary for electric street rail-

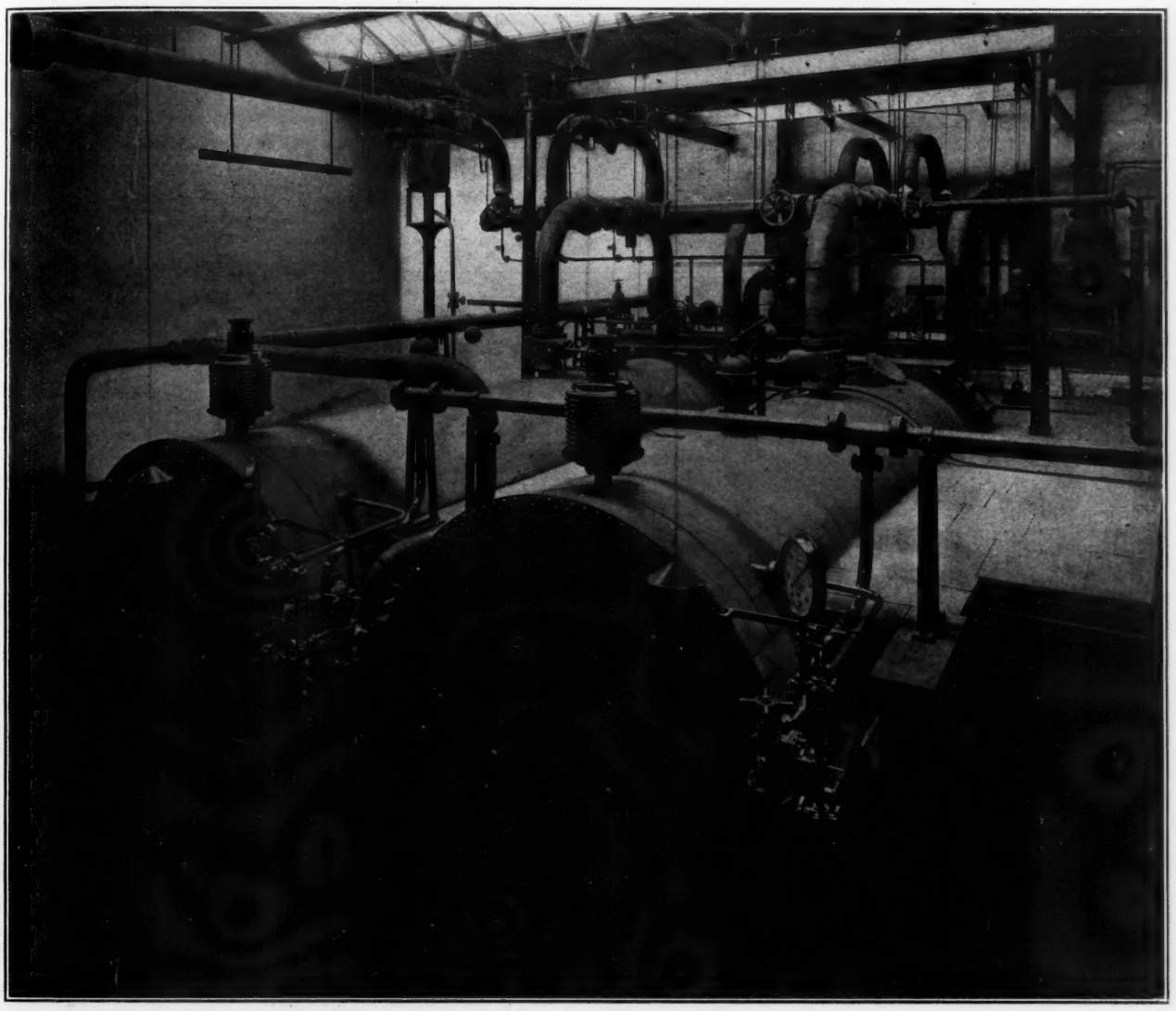
way and other similar service, that duplicate flues be provided for the gases passing from the regenerator so that the plant may be worked without interruption. At Preston a complete duplicate plant has been installed. Green economizers are employed, arranged in three groups, eight pipes wide, with 288 pipes altogether. An engine is provided for operating the scrapers. The economizers are only utilized on heavy loads, a by-pass flue being provided. There is a damper to shut off the entire plant if required, there being a special locking gear on the dampers which renders it impossible for the pull of the chimney to close any of them.

The sanitary department has nothing whatever to do with the electricity department of the city of Preston, and the former having generated the steam at the destructor station, sells it to the electric tramway department of the municipality. The destructor plant supplies the tramway department with sufficient steam to generate 20,000 kilowatt-hours a week, or over one million units per year.

This was found to be sufficient to operate the Preston electric tramways with a length of track of sixteen and one-half miles. Electric power is also supplied for lighting the car sheds and workshops as well as the destructor buildings and steam is furnished for a large Jeffrey disinfector.

The Preston corporation tramways are supplied with current from the municipal power station, having a supplementary boiler house for reserve in addition to receiving steam from the refuse-destructor plant adjoining. This boiler house and pump room is about eighty feet square, with space for four boilers, though but two Lancashire boilers were installed, thirty feet long and eight feet in diameter. The stoking floor is twelve feet wide and runs the whole length of the boiler house. The boilers are designed for working at a pressure of 160 pounds and are each provided with a Bolton superheater placed in the downtake, which is designed to superheat the steam from the boilers to a maximum of 100 degrees above that of the working pressure. An electric motor is utilized for working the scraping gear of a Green economizer which has been provided, consisting of 256 tubes. There are also two vertical tubular feed-water heaters each of 104 square feet effective heating surface.

Electric power is also used for other auxiliary machinery. A single-reduction electric motor with rawhide spur gearing is utilized in the pump room for driving a three-throw single-acting feed-pump having an output of 1,000 gallons per



RESERVE BOILER INSTALLATION, PRESTON, ENGLAND, MUNICIPAL ELECTRIC RAILWAY.

hour at a speed of 100 revolutions per minute. There is, in addition, a direct-acting steam feed-pump capable of delivering 750 gallons per hour and a hot-well and feed-tank beneath the floor of the pump room having a depth of five feet and covered with steel plates.

The engine and generating room is thirty-seven and one-half feet high, fifty-five feet wide and eighty-three feet long. Provision has been made for two 300-kilowatt units and one 500-kilowatt set, the former being installed on foundations of solid concrete twelve feet deep and forty-eight feet long by about twenty-six feet wide.

The two 300-kilowatt compound-wound railway generators were furnished by Dick, Kerr & Company, and are driven by horizontal compound engines built by Cole, Marchanz & Morley, of Bradford; England. They run at a speed of 100 revolutions per minute and have flywheels weighing fourteen tons and measuring sixteen feet in diameter. The high-pressure cylinder is seventeen inches in diameter and is fitted with Corliss valves. The stroke is thirty-six inches and the low pressure cylinder, which is thirty-four inches in diameter, is also fitted with Corliss valve gear, the cut-off of which can be varied by hand while the engine is in motion. The crank shaft is fifteen inches in diameter and is of high-grade steel.

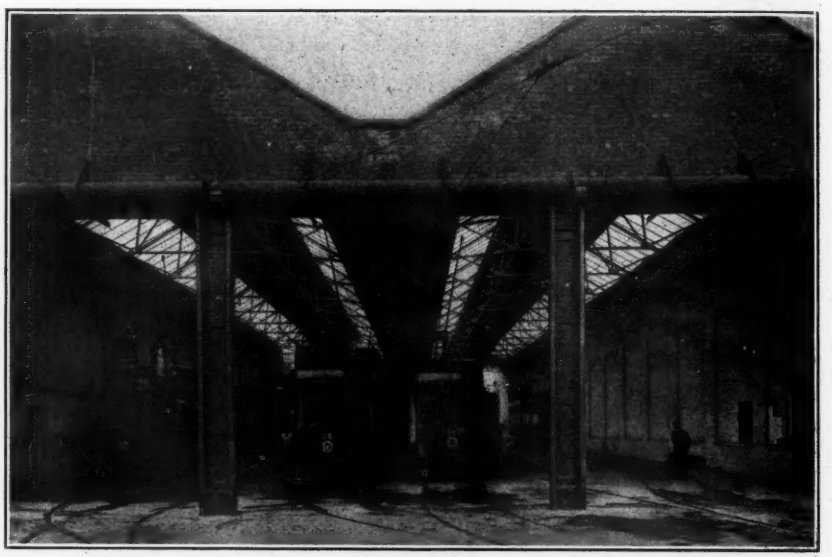
The electrical generators were designed to run with an overload of fifty per cent above normal momentarily and to operate two hours with an overload of twenty-five per cent, the engines indicating 600 horse-power for that period and 700 horse-power at a maximum.

During the official trials of this equipment the combined efficiency of the engine and generator was found to be eighty-five per cent, the consumption being 12.25 pounds of steam per indicated horse-power-hour, or 19.5 pounds of steam per kilowatt-hour, measured at the terminals of the generator.

A cooling tower was provided having an effective cooling area of 70,000 square feet and a capacity of 8,000 cubic feet. The tower is forty-three feet high, twenty-one and one-half feet long and eleven and one-half feet wide and has two cooling fans installed on steel girders, each nine feet in diameter. A ten-horse-power electric motor is used for driving each of these fans at a speed of 110 revolutions per minute, the capacity of each being 62,000 cubic feet of air per minute. For cooling water, the town's supply is used and a fifty-five-horse-power electric motor is employed for driving the complete condensing set, the circulating pump being of the centrifugal type capable of delivering 50,000 gallons of cooling water per hour to a vertical height of forty-six feet, to the cooling tower.

At one end of the engine room the switchboard and accessories are mounted on a platform. The board is of the Ferranti design and consists of eleven black enameled slate panels, two inches thick. There are eight feeder panels, a wattmeter panel and two generator panels equipped with the usual ammeter, voltmeter, recording ammeters, automatic circuit-breakers, double-throw switches, watt-meters and lightning arresters and choke-coils.

Below the switchboard gallery there is



CAR BARNS, PRESTON, ENGLAND, MUNICIPAL ELECTRIC RAILWAY.

a booster set, consisting of one twenty-horse-power shunt wound motor directly coupled to one eight-kilowatt and two two-kilowatt series wound negative boosters constructed by the Phoenix Dynamo Manufacturing Company, Limited, of Bradford, England.

A complete workshop is provided equipped with electrically operated machine tools and a car shed having a steel roof 165 feet long and about seventy-three feet wide. It contains six tracks with accommodations for thirty cars, which are of the double-deck type.

The permanent way, also constructed by the latter firm, has a gauge of four feet eight and one-half inches. There are 6.3 miles of double track and 3.7 miles of single track, the equivalent of 16.3 miles of single track construction. The sharpest curve has a radius of forty-two feet and the steepest grade is one in sixteen. The rails weigh ninety-five pounds per yard on straight track and 101 pounds on curves. They are laid on a bed of concrete eight inches thick, two inches of concrete being above the sole of the rails and forming a continuous anchorage. At each joint two solid Chicago "Crown" bonds are used, 0000 Brown & Sharpe gauge, each thirty-eight inches long, with cross-bonds sixty inches long every forty yards on single tracks, and inter-cross-bonds at every eighty yards on the double track section. The bridging bonds are 00 Brown & Sharpe gauge while all points and crossings are bonded with 0000 bonds at each end and 00 bridging bonds across.

All of the feeder pillars, feeder poles and the metal work on all street boxes are bonded to the track and the bonds are all painted throughout their whole length with compound.

There are seven positive and six negative feeders, varying from one-quarter square inch to one-half square inch in sectional area. These feeder-cables are of the non-metallic sheathed class, insulated with "Dialite," double taped and braided with heavy jute. These cables are drawn into stoneware conduits in tiers of two to twenty-two ducts throughout the various routes and laid in a solid bed of concrete. A three-core pilot cable has been laid along all of the routes for tests and telephone circuits and connected throughout the system to every feeder pillar.

In the city of Preston the cars are operated on a ten-minute service with an accelerated schedule during the rush hour. The stopping places are fixed at approximately 160-yard intervals on all routes.

THE USE OF WOODEN POLES FOR OVERHEAD POWER TRANSMISSION.[1]

BY C. WADE.

The first extra high-tension overhead lines in England were put up more or less by rule of thumb. There were no reliable data from which to settle the requisite strength and size of poles employed. The subject was one of the greatest importance, as it was essential, on the one hand, that the capital cost of the construction and erection should be kept as low as possible; and, on the other hand, that overhead transmission should not be discredited by failure, accident, or disaster. The author, therefore, in August and November, 1906, acting on the suggestion of A. P. Trotter, of the British Board of Trade, carried out an exhaustive series of tests on wooden poles of varying form, lengths, and diameter. During these tests the author had the advantage of the advice and help of Professor Goodman, of Leeds, and the tables printed with the paper were prepared by him.

The first set of tests was carried out in August, 1906, and both single and double poles were experimented upon. The results, however, were not considered satisfactory, as the arrangements for testing were found to be far from perfect. The method adopted of loading and holding the poles caused a large amount of friction and prevented accurate results being obtained.

These tests clearly proved: First, the very marked superiority of an "A" over a single pole, the "A" pole being shown to be at least three times as strong as a single pole, while later and more accurate tests have shown that the "A" is at least four and a half times as strong as a single pole; second, the great flexibility and recuperative power of wooden poles. Some single poles that were tested projected free for thirty-five feet from their housing and deflected thirteen, fourteen and fifteen feet before breaking; and those that were released before the breaking-point was reached showed a very small permanent set. It was soon seen that "A" poles were preferable to single poles both as regards economy and strength. To obtain the required strength in single poles, they would have to be of such a diameter as to be prohibitive in cost, and in some cases unobtainable. More attention was, therefore, bestowed on testing the strength of "A" poles and on finding out the best method of constructing them.

[1] Read before the Institution of Electrical Engineers of Great Britain, May 2. Slightly condensed.

In testing the poles it was desired to hold the butt of the pole firmly to a height of five feet, while the rest of it was allowed to swing free. In the first method, used in August, two heavy timbers were driven into the ground, one for holding the foot of the pole and one for taking the stress five feet up. The top end of the pole was supported on a specially constructed trolley, which ran on a platform under this end of the pole. It was first attempted to load the pole by weights placed on a wooden platform, suspended from the end of a wire rope attached to the pole, carried by a series of pulleys to the top of a substantial frame about twelve feet high. The platform when heavily loaded sank into a pit dug below the frame.

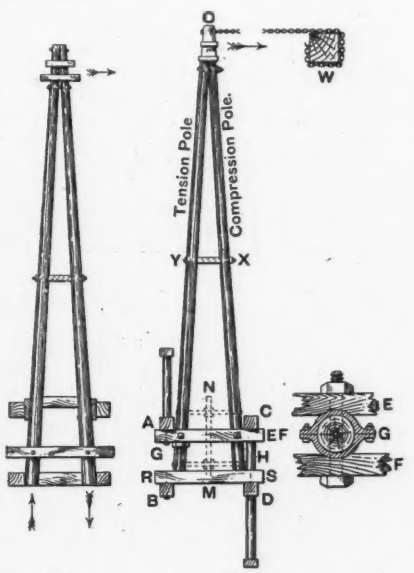


FIG. 1. FIG. 2.

FIG. 1.—First but unsatisfactory method of holding "A" pole for testing.
FIG. 2.—Second method of holding pole for test which prevented all slipping.

This method was quickly abandoned on account of the friction of the pulleys and the time occupied in loading by this crude means. In subsequent tests the load was obtained by a gang of men with pulley-blocks, and a dynamometer was inserted in the loading chains.

A similar method of holding was adopted in testing "A" poles on the flat—*i. e.*, along the line of the wires—and was satisfactory. This acted admirably for single poles, but when "A" poles were tested across the line of the wires in precisely the same manner it was found that, owing to their taper construction, there was so much end slip in the housing, as shown by the arrows, that accurate results were impossible (Fig. 1). When it was found that the strength of "A" poles was the really important point to determine, the author, acting on Professor Goodman's suggestions, redesigned and reconstructed the testing apparatus and the methods of housing the poles, and carried out a new series of tests in December.

In this series of tests—confined almost entirely to "A" poles—a different method of holding was adopted to prevent the poles from slipping in their housings, as shown in Fig. 2. All the poles were about seven and one-half to eight inches diameter at five feet from the butt. The double pole being placed in position, as shown, two heavy blocks E F were bolted to it, one below and one above the pair of poles about two feet six inches from the butt, and, in addition, a heavy iron ring G was bolted to the tension leg of the pole, below the blocks, to prevent them slipping down when under load. The foot of the pole was embedded against a massive timber R S, supported on the poles B D. A block H was inserted, as shown, to give additional stability.

By this means when the load was applied in the direction of the pile W, the leg that was under tension was unable to move away from the balk A and its supports on account of the oak cross timbers, while the leg that was in compression was also unable to move as its foot was pressing against the timber R S. The pole was therefore very rigidly held in place, in fact, far more so than would occur in actual practice.

Professor Goodman suggested and provided a telescope, which was attached to the butt of the pole at M N (Fig. 2), and by this means it was possible to sight a plumb-bob, suspended at O, so that accurate readings could be obtained and any slip of the pole in its housing could be detected and allowed for. The use of a telescope in tests of this kind is a very necessary refinement that is too often overlooked, and one was used by the author in all tests made. The housing requires to be of great strength. The author believes that the results of these tests given in the tables are accurate, as very great care was taken to make them so. In all probability if a load equal to the test-load were applied to a pole carrying wires the whole structure would be pulled out of the ground.

The load was applied in the same manner as in the first series of tests—by pulley blocks—and everything possible was done to eliminate friction. The weight of the pole was taken at the top end by a chain hung from a large pulley running on an overhead cross-pole supported on tripods at each end. This pulley was guided by a line on each side, and the

cross-pole was fixed as nearly as possible level and in the line of the pole's deflection.

In these tests it was found that whereas a single pole would often deflect to a very great extent before breaking, an "A" pole, so long as it held together at the top, would only deflect a few inches. The "A" pole, however, would sustain in a direction across its two members—*i. e.,* at right angles to the line—a load four or five times as great as that of a single pole of the same diameter as one of the two members of the "A" pole. Also experiments show that an "A" pole (as would be expected) is at least twice as strong as a single one of equal section, in the direction of the line, and would only deflect half as much.

Fig. 3 shows that the "A" poles failed in nearly every instance through the buckling downwards of the member in compression. This was due to the initial sag of this member, caused by its own weight, which it was impossible to allow for. To have eliminated this sag it would have been necessary to support the poles in the centre, which would have caused friction, and this it was particularly desired to avoid on account of such friction affecting the accuracy of the results. This was thought of and discussed at the time, but it was decided to carry out the tests in the manner shown. This sag undoubtedly made the poles fail sooner than they would have done had they been in a vertical position, and the results, therefore, are less favorable than they would be in actual practice. But it should be noted that at this point of failure the poles were not actually broken in any way, and if it had not been for the sag out of the line of pull they would undoubtedly have sustained far greater loads. The buckled pole in all cases straightened itself immediately the load was released. In every case the load was applied approximately two feet from the top of the pole, this being about the point where the stress would occur in actual work.

From the tests carried out by the author, it appears that many of the poles in use in England are misproportioned, and this applies particularly to "A" poles. Some are ridiculously too large, while others are dangerously too small. The few that are correct in length and size have been selected more by luck than judgment. The tests showed that the usual breaking-point of a single pole, when tested to destruction, is about five feet above ground level, or about ten feet from the butt. The diameter of a pole at this point is, therefore, the most important dimension to consider in choosing one suitable for certain loads. The top diameter of a pole is also of some little importance, but this is a dimension which Nature settles, and there is no object in altering the natural taper.

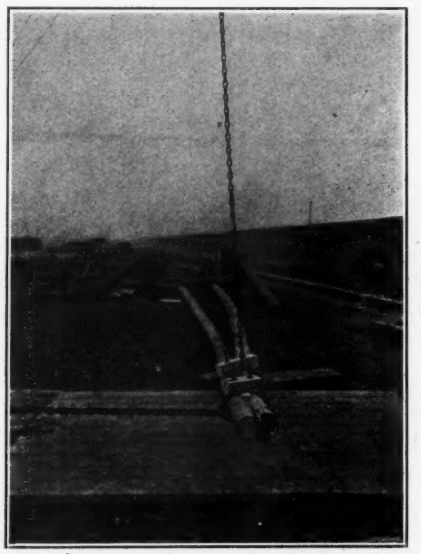


FIG. 3.—ILLUSTRATING THE BUCKLING OF "A" POLES UNDER TEST.

The weakest point of an "A" pole is the top, where the stress due to windage and weight takes place. The two members of the pole—owing to their shape—have a tendency to slide and slip on each other when subjected to a load at the top. One member being in compression and the other under tension, that which is under tension elongates and forces itself away from the member in compression.

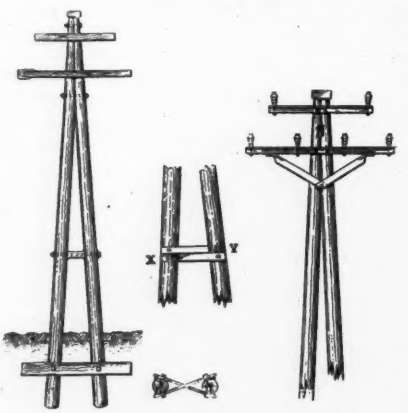


FIG. 4. FIG. 5. FIG. 6.

Fig. 4.—Method of Joining Poles by Scarfing and Bolts.
Fig. 5.—Diagonal Braces which Prevent Twisting.
Fig. 6.—Oak Block Inset in Joint to Prevent Slipping.

The important thing about an "A" pole is its construction and the method adopted to hold its two members at the top. The author's method of securing them is shown in Fig. 4. The two members are scarfed to such an extent as to reduce them to about two-thirds of their original diameter. The length of the scarf depends, of course, on the angle at which the members are set. They are held together by two three-quarter-inch bolts, one about twelve inches and the other about forty-eight inches from the top of the poles. At the foot the two members are tied together by a wooden block about six feet in length, and four inches by eight inches in section, which is let into and bolted to each about two feet from the butt. It will be noticed that the arrangement is similar to that adopted in the tests, which were designed to follow, as closely as possible, the conditions occurring in actual practice.

A centre tie bolt and tubular distance piece is also used between the two members about ten feet above the ground level. Instead of this tie bolt, flat iron plates, fixed diagonally across the poles and bolted to the pole at each end, can also be used with advantage (Fig. 5), by which means, undoubtedly, the pole is materially strengthened, and is prevented from twisting. Angles or channels bolted to each side of the pole, across the two members, serve the same purpose. It is also desirable to insert an oak block in the scarf. This block should be six inches deep and should be let into each member to a depth of about one inch, depending on the size of the pole used (Fig. 6). The tests showed that if the blocks are less in depth or if they are nearly square they tend to twist and bed their corners into the poles and thus force the members apart. One deep block in the scarf appears to be better than several of less depth, inasmuch as the insertion of several blocks weakens the timber, and if they are fixed high up they will, when under stress, squeeze the top part of the member on which they bear clean out of the end of the pole. The oak arms let into the poles to carry the insulators materially strengthen the structure and prevent shearing. For the construction of "A" poles the author recommends this method, which is the one usually adopted, but other methods are sometimes employed.

The lower insulator arms are sometimes tied to the centre of the pole by flat ties or iron plates, which helps to prevent the twisting of the arms and the parting of the two members. The tying together of the ends of the lower and upper arms also helps to strengthen the structure. It is, of course, most important that as little

cutting away as possible be done to the poles, especially at the top, as this weakens the timber.

Whether insulator arms should be composed of oak or angle or channel iron

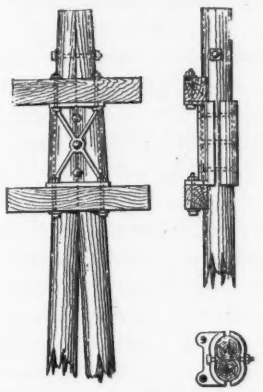


FIG. 7.—ONE TYPE OF POLE TOP CASTING—CROSS-ARMS BOLTED TO FLANGES.

seems a very open question, into which the question of insulation and earthing enters very largely. The life and strength of a wooden arm seem to be equal to those of an iron one, if not more, and wooden arms will no doubt outlast the pole, and are slightly cheaper than iron.

The author has carried out experiments with different forms of castings designed to hold the two members together at the top, both when scarfed and unscarfed. The poles were placed together side by side and held together at the top by the castings.

First (Fig. 7) experiments were made with a casting which enveloped the two members of the "A" pole, after scarfing, between the two usual oak arms. This casting was made in two separate halves, held together by three strong bolts passing through them and between the two members of the "A" pole. The casting was so designed that when drawn up tight on the pole the two halves of it did not quite meet, and at each end of it flanges were formed for the attachment of the two oak arms, these arms being let into the pole to assist in preventing twisting of the members of the pole. The arrangement seemed to hold very well, and only failed in the end through the splitting of the casting, probably owing to a fault in it, or through having been tightened up too much in fitting it to the poles, which thus sustained a comparatively small load, but gave a comparatively small deflection on account of the rigid manner of tying at the top.

The second casting was formed to envelop the two members of an "A" pole when tied together at the usual angle (Fig. 8) without being scarfed or bored in any way at the top, and it was made in two pieces as in the previous case, but was bolted together at the edges as well as in the centre. This failed in the first instance through the slipping of one member of the pole in the casting, while the other held fast, the failure being due to the inequality in size of the two members, in consequence of which the casting did not obtain an equal grip on both members. This was afterwards remedied by the careful selection of two members of equal size, when the result was more satisfactory, and the pole, with one exception sustained a higher load than any other and gave a comparatively small deflection, failing in the end through the buckling of the compression member. The slip of the two members on each other at the top was practically nil. In the author's opinion this is the best means of tying the two members together at the top, and would seem to justify the extra cost in-

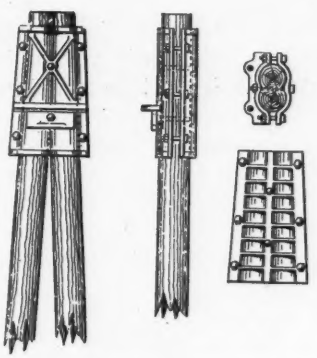


FIG. 8.—TYPE OF POLE TOP CASTING WHICH DOES NOT REQUIRE SCARFING OF POLES.

volved by the more satisfactory results obtained.

A means of holding the two poles together was also tried (Fig. 9A) in which the two members were scarfed together in the usual way and the arms were secured to the poles by wrought-iron bands, the ends of which passed through the arms. A centre bolt was also passed through the backing plate to the other side of the clamp as an additional means of tightening up. An oak wedge was driven up between the two poles to give rigidity, and was held in place by these bolts, and as an additional precaution both members were bolted together by a through tie bolt passing through them at the top and also through an oak block inserted in the scarf at this point. The result obtained was distinctly good, the load being high before failure, although the deflection was fairly large.

This method of holding was considerably improved (Fig. 9B) by placing the oak arms below the plates and letting them into the poles, as shown, which gave them an additional means of preventing twisting. The result obtained showed a great improvement, the load being higher and the deflection distinctly less.

A method was also tried in which a solid casting was placed over the two members after being scarfed; and having been closely fitted, was secured by a bolt passing through the two poles at its base. This gave good results, but the casting shifted considerably out of the perpendicular under load. The casting originally was formed with a flange to carry the oak arm some way up. Though the load sustained was good, it was not enough, in the author's opinion, to justify the necessary expenditure.

This shifting was avoided to a great extent by the insertion of an oak block in the scarf, and an oak arm let into the pole lower down also assisted in preventing twisting. When tried again the pole gave better results, but not so good as was expected. It failed in the end through the fracture of the tension member.

It would, no doubt, be better to place the flange lower down, at the bottom of the casting, and to let into the pole the arm carried by it. This is a cheap arrangement, and in addition it has the advantage of excluding all wet from the top of the pole and also of forming a cap for it, which can be drilled to receive the insulator pin of one line when it is desired to place the line at the top of the pole.

In the series of tests carried out by

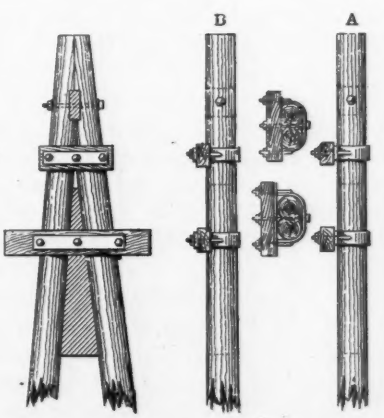


FIG. 9.—POLES SECURED BY WROUGHT-IRON BANDS AND AN OAK WEDGE.

the author and Professor Goodman on February 12 and 19, a heavy "A" pole, each leg being about eleven inches diameter at five feet from the butt, which had been previously tested in August, was

tested again, in order to determine the comparative merits of the two methods of holding it in the housing, it was found that the loads sustained were considerably higher than before, and the failure in the end was caused by the twisting of the oak blocks in the scarf. These, which had been made nearly square, were replaced by longer ones.

Fig. 10 shows the effect of the enormous stress on these blocks. The pole was then tested again and the load it carried was the highest obtained—about four tons, the deflection being only about fourteen inches—not very great considering the weight on it. The final failure was caused, partly by the twisting and splitting up of the blocks in the scarf, but principally by the twisting of the oak cross-pieces, which took the load at the foot. These gave way under the enormous pressure they had to bear, and further results were unobtainable although the two members were perfectly sound at the finish, and not in any way cracked or bent to any visible extent.

Tests were also made with "A" poles spread to different widths at the bottom. The spread which gives strength combined with cheapness of erection was found to be about four feet on a thirty-two-foot pole, or a taper of about one in eight, the measurement being made between the centres of the bolts holding the brace, which tied the members together near their butts. If a smaller spread than four feet is adopted the poles are not so strong, while a greater spread, though giving some extra strength, increases the cost of excavation and way-leaves.

All figures given in the tables were taken from tests of "A" poles with a four-foot spread, measured as above, except where otherwise stated.

A favorite form of constructing a double pole is the "H" formation, Fig. 11, wherein the two members are erected parallel to each other, and are held together by the arms at the top, being strengthened lower down by cross-bracing, or by tie bolts. Their strength depends, of course, entirely on the method and amount of bracing, and if this is extensively done, they will no doubt be as strong, if not stronger, than "A" poles of equal size. They have the advantage of presenting a greater surface than an "A" pole to which to attach wires, and are especially useful for terminals of lines for this reason. When used as terminal poles they are stayed with two or four steel rods or wire ropes at the back, to take the stress of the line.

This "H" formation is also extensively used by the leading users of telegraph lines and telephones for main routes, where the poles have to carry a large number of wires, and where a single or "A" pole would not give the requisite surface.

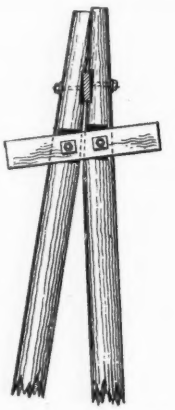


FIG. 10.—ILLUSTRATING THE EFFECT OF GREAT STRESS ON THE POLE.

One advantage of wooden poles that the tests have conclusively proved, is their great flexibility and recuperative power after severe deflections from the perpendicular caused by abnormal stresses. Such stresses are frequently caused during frosts by the contraction of the wires. Where wooden poles are employed, in the very unlikely event of the breaking of all

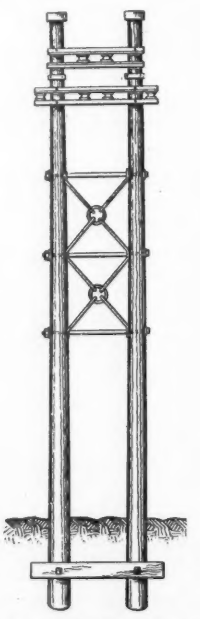


FIG. 11.—A FAVORITE FORM OF THE "H" TYPE OF POLE.

the wires on one side of a pole the first pole on each side of the break would deflect, and each pole further on in either direction would deflect proportionately, thereby preventing any poles breaking and reducing the probable cost of repairs to a minimum. As soon as the line was repaired the poles would come back to their original positions. For further information upon the behavior of poles under such conditions, reference may be made to A. P. Trotter's paper on overhead transmission, recently read before the Institution of Civil Engineers, of Great Britain.

Iron poles, steel lattice masts, and reinforced concrete poles have been used for this class of work, but the author considers that in the event of a breakage, as mentioned above, they would not have sufficient flexibility to enable them to recover. Moreover, they would cost more to buy and erect, and would be much heavier and need better foundations than wooden ones. Again, iron or steel poles would need to be repainted at least once in three years, and, however much care was taken to preserve them, their corrosion would be so great that frequent renewals would be required, whereas a wooden pole, which has undergone an effective preserving process, will last for fifty years or more without attention. Creosoting has been generally adopted by the General Post Office, the National Telephone Company, the leading railway companies and all large users, and gives general satisfaction.

It is most important in creosoted poles not to cut the treated surface if it can be avoided. Cutting away renders useless the most valuable part of the process, as the oil penetrates chiefly the outside or soft part—which is sapwood—of the timber, and any part which it is found necessary to cut after creosoting should be thoroughly tarred over.

(To be concluded.)

New York Electrical Society.

The annual meeting of the New York Electrical Society for the election of officers will be held in the Engineering Societies Building, 29 West Thirty-ninth street, New York city, on June 10 at 8 P. M. The following ticket has been nominated by the nominating committee: for president, Albert F. Ganz; for vice-presidents, Augustus Post, Theodore Beran, W. L. Conwell; for secretary, George H. Guy; for treasurer, H. A. Sinclair.

After the election Dr. William H. Tolman, director of the American Museum of Safety Devices and Industrial Hygiene, will deliver a lecture on "Safety and Security of American Life and Labor," with illustrations from European and American museums of electrical and other safety devices.

"Power Costs."

TO THE EDITOR OF THE ELECTRICAL REVIEW:

I have read with considerable interest the article on "Power Costs," by C. E. Lucke, in the ELECTRICAL REVIEW of May 18. The author's calculation in discussing oil engines convinces me that he did not have the Diesel engine in mind when the article was written, for it is decidedly erroneous as compared with our record as shown by the large number of plants in operation in this and other countries.

Using his own figures, a plant necessary to deliver continuously on the switchboard 1,000 kilowatts per hour could be installed in five units, three of which would be 300 kilowatts and two of 150 kilowatts each, or a total of 1,200 kilowatts. One of the 150-kilowatt units would drive the auxiliaries and the other would represent reserve capacity. There is no fiction about this, as the American Diesel Engine Company will absolutely guarantee a plant as described to deliver 1,000 kilowatt-hours on the switchboard continuously, or for 8,760 hours per year.

This plant, including the engines, all electrical equipment and auxiliaries, foundations, freight, building and real estate, could be easily installed for $140 per kilowatt, *i. e.*, $168,000 for the entire plant of 1,200 kilowatts necessary to deliver 1,000 kilowatts on the switchboard continuously with the reserve as shown, or $168 per kilowatt for that portion of the plant in continuous service.

The fuel consumption of this plant can be guaranteed at not to exceed twelve and one-half gallons of oil for each 100 kilowatt-hours delivered on the switchboard on a fifty per cent load-factor, or ten and one-half gallons of oil for each 100 kilowatt-hours delivered on the switchboard at 100 per cent load-factor. In fact, the economy of the Diesel engine is such that the fuel consumption per brake horse-power-hour is almost constant from half-load to full load. Furthermore, the oil engine using products of petroleum utilizes the only fuel in existence where the heat value is always constant. There is practically no difference in the British thermal unit per pound of fuel, whether the oil is natural crude, or a product of distillation, or whether the oil comes from California, Texas, Kansas, Indiana, Ohio or Pennsylvania. This freak of nature eliminates entirely any uncertainty as to fuel consumption for work done. Furthermore, in the oil engine, especially the Diesel type, the fuel consumption is absolutely independent of manual control, and if the load varies the fuel must be always exactly in proportion to the indicated power developed by the engine. That is, of course, assuming that the engine maintains constant speed under variable load.

A plant as described operating continuously would use about the number of attendants that the author figures on, although we have a large number of plants operating with less attention.

For lubricating oil each of the 300-kilowatt units would require two gallons for each twelve hours and each of the 150-kilowatt units require one gallon for each twelve hours, the total being eight gallons of oil at thirty cents per gallon per day of twenty-four hours, or a total of $2.40 per day, or $876 per year.

	Cost per Kilowatt-Hour.	Cost per Kilowatt-Year of 8,760 Hours.
Fuel oil at three cents per gallon	3.15 mills.	$27.59
Lubricating oil and waste	.1 "	.88
Operating labor	.465 "	4.07
Maintenance and repairs 5 per cent on $168,000, or $8,400 per year	.96 "	8.40
Fixed charges 10 per cent on $168,000, or $16,800 per year	1.92 "	16.80
Total cost of one (1) kilowatt per hour	6.595 "	
or about two-thirds of a cent per kilowatt-hour on switchboard And on this basis the cost of 1 kilowatt per year of 8,760 hours would be		$57.74

On the question of fixed charges, we will assume the author's figure, which is ten per cent of the cost of the plant, and have added five per cent for maintenance and repairs, although one per cent would be sufficient if this charge was only intended to cover the actual cost of material to replace worn-out or defective parts.

On this basis a plant capable of delivering continuously 1,000 kilowatts per hour would cost per kilowatt-hour on the switchboard, as shown in the accompanying table.

The amount allowed for maintenance and repairs is absurd, as any company offering a prime mover that would cost five per cent per year for actual repairs would be driven into bankruptcy, and the Diesel engine plant as described above if given ordinary fair treatment could not exceed $1,000 a year for this item, even allowing for unusual conditions of operation, and the cost of one kilowatt-hour on the switchboard in continuous operation for 8,760 hours a year and under the load conditions described above would not be over $50 a year per kilowatt.

The conditions of operation as described in the article are ideal; *i. e.*, continuous service at full load, and present the best possible proposition for the steam plant or the producer plant. In other words, both plants are operated at their highest possible economical rating. Furthermore, this is a condition rarely found in actual service. The ordinary electrical plant has a variable load and usually runs to a peak, and it is seldom that the average load-factor exceeds fifty per cent. In a steam or producer gas plant this means severe stand-by fuel losses; and in the steam engine particularly means greatly increased steam consumption per kilowatt-hour delivered. In the Diesel engine this is entirely eliminated, and, provided the load-factor will average fifty per cent, the fuel consumption can be guaranteed very close to the rating at full load. Consequently, while the Diesel engine will show a much higher economy on the conditions as described in your article, it is infinitely superior to any other prime mover where the loads are variable as one finds them in actual operation.

The above statement is absolutely correct. We have a large number of plants operating inside of this limit and the American Diesel Engine Company would not hesitate to give a surety bond to guarantee these figures if based on the specifications as shown above.

NORMAN MCCARTY,
General Sales Manager,
American Diesel Engine Company.
Indianapolis, Ind., May 24.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., June 18 and 25, for the following material: Two armatures for delivery at New York city; 3,600 feet of enameled steel conduit, Boston, Mass.; miscellaneous electrical supplies, Pensacola, Fla., Boston, Mass., and Norfolk, Va.; four electric breast drills, Washington, D. C.; twenty-six 110-volt arc lamps, Boston, Mass.; one motor-generator set, Mare Island, Cal.; four steel switch boxes, Boston, Mass. On June 11, 13 and 18, for seven non-water-tight annunciators, Boston, Mass.; eighteen water-tight annunciators, Boston, Mass.

Electrical Notes from Great Britain.

(From Our Special Correspondent.)

ELECTRICAL manufacturing in this country continues to be in a very unhealthy state. The concerns that are successful at the moment are those that are doing business upon lighting, power and traction undertakings in foreign countries, or are financially interested in the home systems for which they are supplying the plant, or else they belong to a particular branch of the industry where an understanding exists between manufacturers—as in the case of the cable-making companies. It is in the last group that substantial profits are being earned, but there are other cable firms not in the group, who are striving hard just now to "prick the ball." Manufacturers of most kinds of electrical machinery and apparatus have experienced great difficulty from the continued high prices of materials and the uncertainty as to what course they are going to take. The position has just been stated from the electric cable-makers' point of view by the board of Callender's Cable and Construction Company, Limited. This company has just completed the twenty-fifth year of its operations, and it has had a career of most enviable good fortune for some years past. It has paid a very substantial return (fifteen per cent) to its ordinary shareholders for last year's operations, and it summarizes recent events in words to the following effect: There was, early in the year, a large demand for cables, etc., but, during its concluding months sales were restricted owing to the unusually high prices of metals, and especially of copper. The prevailing copper position is unsatisfactory from the consumer's point of view, the uncertainty as to its future being a greater factor in restraining business and interfering with electrical enterprises, than even the present high prices. As a result, few important contracts for new mains have been entered into during the past six months, and a waiting policy has, in the meantime, been adopted by many would-be purchasers. The possibility of new government action relating to the future of electric supply has also led existing undertakings to stay their hands, while it has also postponed new undertakings. Therefore English business, for the present, has been chiefly confined to extensions to existing cable networks. The cable manufacturing business has also suffered to some extent by the failure—only temporary perhaps—of some of the big power companies to acquit themselves satisfactorily, for this fact has put something of a brake on such development, and electric power and light undertakings are coming more and more into disfavor as investments.

There have been a number of fatal electric-shock occurrences during the last few weeks. A stoker at the Southeastern Hospital climbed a ladder in the pump room to move an electric lamp that was hanging from a ceiling hook near to a water-valve that was to be overhauled. He was instantly killed, and the verdict was "accidental death caused through a defective lamp." At Acklam Ironworks, Middlesbrough, a workman had hold of an iron bar and at the same time held a piece of plate which caught on an electric wire, piercing the insulation. The voltage was 250. At the Trafford Park works of the British Westinghouse Company a young student was found on the floor of the test room with his hands in contact with live wires, and all attempts to restore animation were unavailing. An engine driver at a colliery at Cwm was killed through clutching a lighting wire which had been repaired, after a fashion, by a man who had no business to touch it, and who admitted that he knew nothing about electricity and that he had not reported its defective condition—the result of an accident—to the management. To this list of accidents of a kind which is all too common, we may add one other which happily is the only one of the kind that we remember in this country. Two Sheffield practical jokers employed in an engineering shop wanted to "get their own back," so they connected a live wire to the inside handle of their door. Men from a neighboring steel-works who came to the door received shocks. One, named Lingard, twenty-four years of age, was killed on the spot, and leaves a widow. The affair ought to be printed in big letters for the benefit of those who are inclined to play practical jokes with electricity at ordinary supply pressures.

The post-office authorities have been seeking powers to make use of the posts, standards and brackets of the electric tramway authorities throughout the country as supports for their telegraph and telephone wires. The tramway authorities became indignant at the attempt made to get clauses inserted to this effect without giving them early intimation of the idea. The postal authorities desire power to lengthen and alter the poles, etc., at their own cost, of course, and to give fourteen days' notice of intention to make use of them. The Municipal Tramways Association has taken strong action in the matter, and the Light, Railways and Tramways Association, which may be said to represent the interests of tramway companies, has also asked for a voice in any settlement of details of clauses covering the matter. The postmaster-general contends that his proposals involve nothing inimical to tramway interests, but he is prepared to consider amendments of detail. The negotiations between the various interested parties are proceeding.

In the course of his presidential address to the Institution of Mechanical Engineers, T. Hurry Riches observed concerning the utility of electric traction on goods and mineral traffic, that it would be worth while to seriously consider regenerative control. In South Wales and many of the mining districts there are cases where the loaded wagons come down hill and the empties have to be taken up. If it were possible to use the gravity and momentum of the down train to generate current for the up traffic, and that at a reasonable cost, it ought to make an enormous difference in the possibilities of electric traction for such purposes. "Why," he asked, "should not the slowing and stopping of trains be done by retardation of the electric motor instead of by brake-blocks, and this force returned electrically to the generating station for other use? When I have spoken of this to electrical engineers I have been met by the reply that they can use electric brakes, but where is there a safe one, and where is the saving unless the retardation creates current that can be usefully absorbed elsewhere?"

The Iron and Steel Institute has been holding its spring meeting in London. The sole paper of electrical interest was read by D. Selby Bigge on, "Electricity in the Iron and Steel Industries." He said that few industries had provided a

greater scope for new applications of electric power than these trades. After classifying rolling mills into those which have blast furnaces adjacent and those which have not, the former being in a most favorable position so far as low cost of generation was concerned, he proceeded to set out the various financial gains and advantages that are to be derived from electric rolling mill equipments and complete electrification schemes. He then gave a description of an interesting installation which recently commenced running at the Hildegardehütte at Trzynietz in Austrian Silesia. These works have been reconstructed and electricity was selected to bring the plant up to a state of modern efficiency. The reversing mill has been running since July last. There is one reversing rolling mill, 10,350 horse-power maximum; one non-reversing mill, 750 horse-power normal; and three hundred motors varying from five to seventy horse-power, are in service. Further extensions that are being made include two continuous rotation rolling mills, each 750 horse-power normal capacity, together with sundry pumping and other auxiliary plant, and when these are completed the whole of the power items, excepting the blowing engines, will derive their power from the one electric power generating station which is equipped with Parsons three-phase turbo-generator plants, one of 3,000 kilowatts and two of 1,250 kilowatts. Two motor-generator sets serve for lighting purposes about the works. Mr. Bigge entered in fullest detail into the performance of this original installation which he described as a most carefully thought-out and practical scheme. He urged upon British steelmakers the importance of giving the most minute consideration to the matter with a view to maintaining their position, for although this first reversing rolling mill had only been in operation about nine months, owners and managers of other continental steel-works had lost no time in availing themselves of the innovation. Two electric reversing rolling mills of 10,000 horse-power each had been started up at the Resicza Ironworks in Hungary, while one of 15,000 horse-power was being erected at the Rombacher Ironworks near Metz, and yet another was to be installed at Hüsten. The author concluded thus: "The day of the electric rolling mill has come, and it has come to stay. The preliminary electric rolling mill equipments are but the first stepping-stones to a complete revolution in the methods of rolling iron and steel."

Electrical engineers and manufacturers will be found expressing an earnest hope that Mr. Bigge is right in this, for at present few indeed are the new electric supply systems that are being installed, railway electrification work has not come yet to anything like the extent expected, and new tramway schemes are being delayed or abandoned. In railway electrification the next important undertaking will be the London & North Western Company's tube and surface line from Euston to Watford. The extension of the City & South London tube northwards from Islington to Euston is now completed and opened. The only tube line constructing, and that is nearing completion, is the Charing Cross, Euston & Hampstead. The only surface lines in process of electrifying are the single-phase sections of the Midland and the London, Brighton & South Coast. In regard to tramway work the motor-omnibus will doubtless continue to delay, if not causing abandonment of, certain kinds of tramway extensions. The report of the Brush Electrical Engineering Company, Limited, has a special interest in this connection. This company spent about $70,000 last year for "experiments and excess cost of work carried out on new lines of manufacture (principally main line rolling stock and commercial motor vehicles) entered upon by the company in consequence of a diminution in the demand for tramway rolling stock." By the way, the London County Council is now going to manufacture its own electric tramcar bodies—or to experiment in that direction with fifty cars, by the direct employment of labor at its Leytonstone depot. A number of other important municipal authorities have done it with a questionable saving for years, but London is one of the principal places in the kingdom which will be needing tramway rolling stock to any extent for several years ahead. The events of the last year or two in England have shown how necessary it is for manufacturing concerns to follow most closely the trend of development and its probable effects upon their own particular department of industry.

The Institution of Electrical Engineers devoted its sitting of May 16 to a joint contribution by F. Handley Page and Fielder J. Hiss on the present state of direct-current design as influenced by interpoles. After dealing with the limits of direct-current machinery, and with the subject of calculation of the interpole connections, the effect of the interpole on direct-current machinery came in for treatment at length. The points in favor of interpoles were brought out in the authors' conclusions. It was stated that the question which faces the manufacturer is whether auxiliary poles should be regarded merely as adjuncts to a standard line of machines, arrangements being made that they may be fitted to variable-speed, variable-voltage, and generally difficult cases with a minimum of cost, or whether new designs should be got out. To make full use of the advantages a complete rearrangement of the design is necessary. For large machines, it was pointed out, the works cost will be cheapened owing to: (1) The higher armature reaction employed, the extra cost of the interpole copper and winding being more than offset by the increased output obtained and the saving on the main field, no ampere-turns being required for armature reaction. (2) The smaller air-gap, which still further reduces the amount of copper required. (3) The armature can be made longer and of smaller diameter thus effecting a great saving in the mechanical design and labor costs. (4) A smaller commutator, giving a better ventilated armature and a cheaper mechanical construction.

The working qualities will, according to the authors of the paper, be improved owing to: (1) The smaller number of segments, which will minimize the trouble so often experienced due to high micas or bars. (2) Better commutating qualities, a properly designed machine giving no load to fifty per cent overload without shifting of the brushes, or any signs of sparking. (3) It follows that there will be less attention required at the commutator and less frequent renewal of brushes.

ALBERT H. BRIDGE.

London, May 25, 1907.

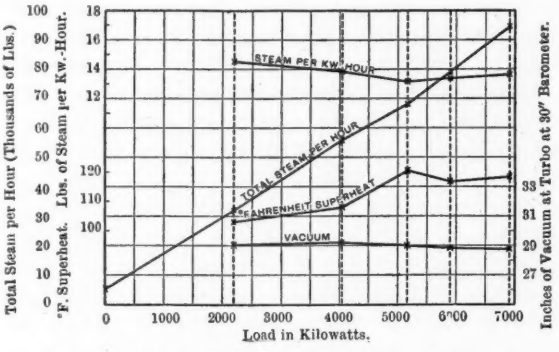
Production of Coal in 1906.

According to statistics compiled for the United States Geological Survey by Edward W. Parker, coal-mining expert in charge, the total production of coal in the United States in 1906 was 414,039,581 short tons of 2,000 pounds, valued at $512,610,744. These figures, compared with those of the preceding year, when the output amounted to 392,919,341 short tons, valued at $476,756,963, show an increase of 21,120,240 short tons, or 5.4 per cent, in quantity, and of $35,853,781, or 7.5 per cent, in value.

Good Performance of a Turbo-Alternator.

A series of tests was made on February 17 by C. H. Merz, of London, England, of a 3,500-kilowatt Parsons turbo-alternator which had been in service for six months at the Carville power station showed an excellent performance. The following description of the tests is taken from the official report:

"The object of the test was to ascertain the steam consumption of a 3,500-kilowatt Parsons turbo-alternator under various loads. The following tests were made: No. 1, no load (non-excited), duration half hour; No. 2, no load (excited), half hour; No. 3, 2,000 kilowatts, one hour; No. 4, 4,000 kilowatts, one and one-half hours; No. 5, 6,000 kilowatts, one and one-half hours; No. 6, 7,000 kilowatts, half hour; No. 7, 5,000 kilowatts, one hour. Loads were kept as nearly constant as possible throughout by means of the exciter field rheostat. The weight of condensed steam was measured by the company's tank and weighbridge, which had on the day previous to the test been calibrated. The vacuum was measured at the turbine exhaust chamber by a mercury column. Steam temperature and pressure were taken at the turbine stop-valve. The speed was taken by a tachometer. In the final consumption results only the actual output of the generator has been taken into account, no deduction being made for any auxiliaries. The field current of the exciter was supplied from an entirely independent source, but apart from this the machine provided its own excitation. The neutral point of the generator windings was disconnected from earth, and the three phases were loaded by means of a water resistance. The output of the machine was measured by a special wattmeter and by the switchboard integrating wattmeter. The current was measured by a special ammeter connected to the same current transformer as the special wattmeters, and by the switchboard ammeter. These instruments were connected in different phases, giving the balance of load between phases. An ammeter was also placed in the exciting circuit. The switchboard voltmeter, indicating wattmeter, and power-factor meter were in circuit, and were read every five minutes to check the accuracy of the wattmeter. The special instruments and the switchboard integrating wattmeter were all carefully calibrated both before and after the test, and corrections were made in the measured output in accordance with the mean of the observed errors at the before and after calibrations. A summary of the results is given in the accompanying table. Consumption and load variation curves, which have been plotted from actual readings, are also appended.


Total Steam per Hour (Thousands of Lbs.)
°F. Superheat. Lbs. of Steam per Kw.-Hour.
Inches of Vacuum at Turbo at 30" Barometer.
STEAM PER KW. HOUR
TOTAL STEAM PER HOUR
FAHRENHEIT SUPERHEAT
VACUUM
Load in Kilowatts.

RESULTS OF TESTS PLOTTED FROM ACTUAL READINGS.

"A whistle was sounded at the commencement and finish of each test, the first reading being immediately taken at the whistle and thereafter at intervals of five minutes. The lift-pump discharge-valve was at the signal closed to the hot-well and opened to the weigh-tank.

"To verify the steam consumption at the most economical load, a further test, No. 8, consisting of three hours' run at a load of 5,000 kilowatts, was held on Saturday, February 23, under the same conditions as before. The figures obtained corroborate the previous tests, the slightly poorer results being due to the less superheat."

TURBINE PERFORMANCES.

Test No.	Duration (Hours.)	Mean Calibrated Kw.	Steam.			Speed R. P. M.	At Turbo Exhaust.	Water.		
			Pressure.	Temperature at Turbo °F.	Superheat °F.		Vacuum at 30" Brm.	Total Condensed Pounds.	Pounds per Hour.	Pounds per Kw.-Hour.
1	½	No load not excited.	180	460	80	1,200	28.875	1,835	3,670	....
2	½	No load excited.	211	453.3	61	1,200-	28.95	2,603	5,206	....
3	1	2,192.87	202.4	492.1	103	1,200	29.036	31,835	31,836	14,517
4	1½	4,045.14	197.4	495	108	1,200	29.066	83,972	55,981.3	13,839
5	1½	5,901.	195.8	503.2	117	1,200	28.95	119,182	79.454.6	13,464
6	½	6,921.8	198.4	505.5	118.5	1,200	28.765	47,390	94,780	13,692
7	1	5,164.07	199.9	508.5	120.5	1,200	29.039	68,180	68,180	13,189
8	3	5,059.38	194.5	477.9	92	1,200	29.195	203,559	67,853	13,411

Silver Loving Cup Presented to C. E. Trump.

At the planked shad dinner given by Charles E. Trump, president of the Novelty Electric Company, of Philadelphia, Pa., at Washington Park, on Tuesday, May 28, the host was surprised with the presentation of a solid silver loving cup of special design and beautifully engraved and decorated. Mr. Trump has given these dinners annually for fifteen years, and all the gentlemen from New York who were present at the first gathering were in attendance last week, apparently more youthful, enthusiastic and fish hungry than ever. The cup was inscribed with the names of the donors, and an eloquent and classic speech full of recondite information respecting the shad, its history and origin, was delivered by Captain W. L. Candee, who was one of the original guests, and who has never missed the annual gathering. Mr. Trump, though taken completely by surprise, responded gracefully, concluding with the agreeable statement that these annual shad events would occur as long as that fish existed and the pioneer shad eaters continued to attend.

Colonel Ezra De Forest, assisted by Mr. George T. Manson and Mr. W. H. Hodgins, had charge of the transportation of the cup from New York to the dinner table at Washington Park, N. J. They were quite successful in concealing its identity from the host, Mr. Trump being told that the package contained extremely valuable life insurance papers that it would not do to leave in the recommended railroad check room at Broad street (where the cost was "only five cents"), as they had to be delivered to the company's office in Chestnut street at sharp five o'clock that afternoon. This plausible statement from such a guileless source of course aroused no suspicion in Mr. Trump's mind, and the surprise was complete when the "valuable papers" were suddenly transformed into the handsome silver gift on Mr. Trump's plate at the conclusion of the words of presentation. The usefulness of the cup was promptly and adequately proved.

The Syracuse Lighting Company.

After a special meeting of the stockholders of the Syracuse (N. Y.) Lighting Company on May 24, at which a new board of directors was chosen, the directors organized and elected officers of the company.

John J. Cummins was re-elected president. He has been serving also as general manager.

J. C. Delong, who is regarded as the active representative of the United Gas Improvement Company of Philadelphia in its control at Syracuse, was elected vice-president and general manager. The other officers chosen are: vice-president, Walton Clark, of Philadelphia; treasurer, Lewis Lillie, of Philadelphia; secretary, L. L. Waters; assistant treasurer and assistant secretary, W. R. Goudy.

Mr. Lillie, who succeeds A. K. Hiscock as treasurer, is treasurer of the United Gas Improvement Company.

At the stockholders' meeting the number of directors of the company was reduced from fifteen to nine. The new board is as follows: Lewis Lillie, George S. Philler, of Philadelphia; J. C. Delong, Henry Seligman and Stephen Peabody, of New York; Albert K. Hiscock, Hendrick S. Holden, John J. Cummins and L. L. Waters, of Syracuse.

Annual Meeting of the Virginia State Independent Telephone Association.

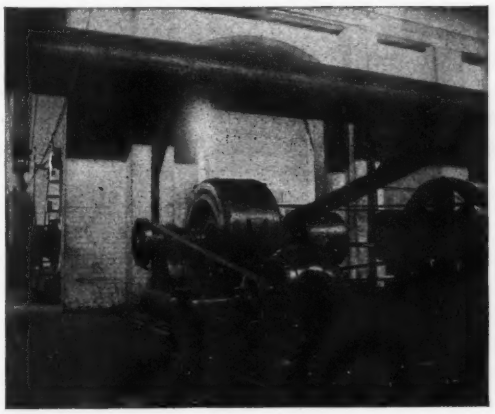
The Virginia State Independent Telephone Association, which convened at Norfolk, Va., May 21 and 22, will meet again in Norfolk in August, to receive the report of its special committee on the subject of the effecting of agreements for the establishment of independent long-distance telephone lines all over Virginia.

The committee was named by President Parlett from among the executive committee, which was chosen as follows: George B. Keezel, of Rockingham county; Albert Parlett, of Bristol; W. N. McAnge, of Suffolk; J. Davie, of Lawrenceville, and C. Fred Bonney, of Norfolk.

Officers for the year were chosen as follows: Albert Parlett, of Bristol, president; F. F. Marbury, of Alexandria, vice-president; W. N. McAnge, of Suffolk, second vice-president; B. L. Fisher, of Rocky Mount, secretary and treasurer.

A Non-Stop Run.

Electrical generators have become such a standard product that attention is seldom called to that thoroughness of design and construction which results in such a record of reliability as that shown in the following statement concerning a 150-kilowatt, three-phase, belt-driven alternator built by the General Electric Company, Schenectady, N. Y. This generator ran more than four years, twenty-four hours a day, with a single stop of fifteen minutes due to a defective pulley. The details of this performance are given by Mr. Rhodes, assistant manager of the United States Smelting Company, West Jordan, Utah, as follows:



THREE-PHASE GENERATOR WHICH RAN MORE THAN FOUR YEARS WITH BUT A SINGLE STOP.

"The generator was received about June 1, 1902. Put in service October 15 for eleven hours per day until November 9, when twenty-four hours per day service was required. January 25, 1904, shortly after noon, the paper pulley on exciter went to pieces. A cast-iron pulley being on hand, a shut-down of fifteen minutes was recorded. From June 13 to 18, 1904, the switchboard was moved, and all feeder circuits were connected directly on the machine without switches or fuses, by means of jumpers, without a single mishap to cause a shut-down. Last fall one of the screws worked out of one of the split oil rings on pulley end. Not being able to shut-down, we ran along with the remaining one till March 28, 1907, when the machine was shut-down for three days; thoroughly cleaned out, new oil put in bearings, collector rings turned true, the broken oil ring fixed and service commenced as usual, vacouline oil being used during this run. The alternator is belt-driven, and an engine located at each side with belt attached in case of emergency. Bearing in mind that this machine carries a continuous overload of 25 to 60 per cent, its record is truly wonderful."

Transmission Line Calculations.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

I would like to refer this example to your question box and thank you kindly for an answer in your weekly review.

F. W. Fox.

712 Dillaye Building, Syracuse, N. Y.

Example:

Sixty-cycle, three-phase, 10,000-kilowatt receiving end, thirty miles of transmission line, 30,000 volts at receiving end; also total energy loss in transmission not to exceed fifteen per cent, power-factor eighty-five.

Is it necessary to give the characteristics of transmission line in ordering generating apparatus from the manufacturer? Are the figures given below correct?

$$\frac{30{,}000}{\sqrt{3}} = 17{,}341 \text{ volts.}$$

$$\frac{10{,}000}{3} = 3{,}333 \text{ kilowatts.}$$

$$\frac{3{,}333}{0.85} = 3{,}921 \text{ apparent kilowatts.}$$

$$\frac{3{,}921.000}{17{,}341} = 226 \text{ amperes.}$$

I. R. drop ten per cent of 17,341 = 1,734.1 volts.

$$\frac{1{,}7341.1}{226} = 7.67 \text{ ohms.}$$

$$\frac{7.67}{30 \text{ miles}} = 0.255 \text{ ohm per mile.}$$

$$\frac{0.255}{5.280} = 0.048$$

No. 0000 wire.

Characteristics of transmission line: Reactance ohms, 16.8 single conductor. The inductance is 44.4 millihenrys. Charging current, 3.84 for single conductor, thirty miles wire.

International Association of Municipal Electricians.

The twelfth annual convention of the International Association of Municipal Electricians will be held at Norfolk, Va., August 7, 8 and 9, in the city hall of that city. The following papers have been announced for the meeting: "Electrical Inspections and Records," "Modern Application of Storage Batteries," "The Value of Volt and Ammeter Tests for Insulation," "A Modern Fire-Alarm Central Office," "Operation of a Municipal Electric Light Plant." On August 9 there will be special features at the Jamestown Exposition of interest to the association.

The secretary of the International Association of Municipal Electricians is Frank P. Foster, Corning, N. Y.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A System of Danger Signals for Warship Turrets.

With warships having a number of turrets, it is possible for one to be turned so as to be exposed to the fire of others. The danger may be either to the rear of the turret or to the muzzles of the guns, depending upon the position of the turret. It is possible to avoid entirely this danger by placing fixed stops, and thus limiting the motion of each turret, but this would reduce considerably the effectiveness of the vessel. To avoid this danger, W. D. Kilroy has devised a system of automatic signals which has been adopted by the British Navy, and which indicates and announces in each turret when another is exposed to its fire. The system consists of a number of electrical circuits and switches operated by cams attached to the walls of the turret. As the turrets are shifted in position, these switches are closed, and whenever one is exposed to the fire of another the connections are such that a telephone trumpet with a loud tone is sounded incessantly within the turret, and can only be stopped by shifting the latter until the danger is eliminated. No precautions are necessary in using the system; the only duty to be observed is not to fire a gun as long as the trumpet is sounding. The latter is a loud-speaking telephone operated by alternating current. At the same time it sounds it operates a visual signal indicating danger.—*Abstracted from Engineering (London), May* 10.

Electric Heater and Ventilator.

An interesting electric heater has been devised by T. E. Weaver, of Wolverhampton, England, which he believes has some advantages over the simple resistance type. The novelty of the new device is in the method of producing the heat. Instead of passing the electric current through a resistance, it is utilized to drive an electric motor, upon the shaft of which is attached a fan, the latter being used for circulating the air passing through the motor. The motor itself is enclosed in a metal cylinder, which forms the field yoke and has salient poles. The air-gap is unusually large, and the armature carries upon its periphery a metallic sheathing consisting of bars of non-magnetic metal securely bolted to the motor. As the armature rotates within the magnetic field, eddy currents are set up in the sheathing, thus raising the bars to a high temperature. The latter are arranged askew so as to force the air axially along the air-gap, and it thus becomes highly heated, and thence, by means of the fan, is forced out into the space to be warmed. Although the bars reach a fairly high temperature, the cooling action of the air and the method in which they are mounted upon the armature prevent them from damaging the windings. On account of the unusually long air-gap, the exciting current is considerably larger than that generally employed for motors of similar size.—*Abstrated from the Electrical Engineer (London), May* 17.

The Brennan Mono-Railway.

A fairly complete description is given here of the Brennan mono-railway, exhibited recently before the Royal Society of London, England. The peculiarity of this system lies in the fact that the cars run on a single rail, although the centre of gravity is considerably above the top of the rail. Stability is maintained by means of a system of gyroscopes, which resist all lateral movement. The car itself runs on two two-wheel trucks placed in the front and rear, swiveled to allow vertical and horizontal movement, so that it takes easily all curves, either in horizontal or vertical planes. During the tests, the car was run over an experimental track laid without reference to the character of the ground; and over a stretched cable which represented a bridge. This method of maintaining stability on a single rail has been tried before, but apparently without success. The method by which stability has been obtained here consists in the way in which the gyroscopes are utilized. When a gyroscope is revolving in a plane, a couple applied to the axis of rotation, tending to twist this out of position, sets up a reaction due to the gyroscope at right angles to the applied force, and also at right angles to the axis of rotation. This effect is utilized by means of two gyroscopic flywheels maintained in rotation at a high speed by means of electric motors, and mounted on special bearings and enclosed within exhausted cases, so as to reduce bearing and wind friction to a minimum. The two wheels are mounted on gimbles, but geared together so that when the axis of one tends to turn to the right, the other must turn to the left. The two wheels, it should be mentioned, rotate in opposite directions. This combination is mounted on a trunnion frame, which alters its position whenever the body of the car is moved. This shifting is utilized to cause the car to return to its original position. To do so requires that the trunnion itself move. It is not explained how the trunnion is returned to its original position without shifting the car body in the opposite direction. The weight of the flywheels is said to be one-fifth that of the loaded car. This gives stability under all conditions. The system is said to be particularly suitable for rough country, as it is independent of grades; it is advantageous to employ wide cars; high speeds are easily attained, as the running of the car is smooth and free from oscillation, and the cost of laying the track required is much less than that of building even a light railway. The system is easily installed, and thus is particularly suitable for military purposes.—*Abstracted from the Electrician (London), May* 17.

The Compensated Electrodynamometer.

Although the Kelvin balance is the standard instrument for the measurement of alternating currents, it is a slow instrument in practice, and is difficult to use when the currents are not entirely steady. Moreover, in the instruments for heavy currents, there are eddy currents in the metal parts of the balance which may cause appreciable error when the frequency is above that ordinarily employed, or if the currents have distorted wave shapes. To supply the need for an instrument not involving these disadvantages, a type of compensated electrodynamometer has been developed by Dr. E. B. Rosa, who here describes the results of his study. This instrument has two circuits, through one of which the main current flows, and through the other, a small current due to the fall of potential caused by the main current in a suitable resistance or shunt. When used in this way, the instrument is really a wattmeter. The deflection is unaffected by the self-inductance of the shunt and by

the frequency of the alternating current and wave-form. The instrument must, however, be compensated for several errors which would otherwise be introduced. To correct for the inductance of the fine-wire circuit, a condenser is connected in parallel with the resistance usually connected in this circuit. A study has been made of this method of compensating, and it is shown that this can be done, provided there are no eddy currents in the large wire coil. When these exist, a torque will be set up in the movable coil, and cause a deflection, in spite of the compensation. A complete study has beeen made of this effect, to show how to reduce it to a minimum and to compensate for the residual effect. The range of this instrument may be varied either by changing the resistance of the shunt or the resistance of the small wire. The ease with which the range may be changed is one of the great advantages of this instrument.—*Abstracted from the Bulletin of the Bureau of Standards (Washington), April.*

The Electrical Equipment of the Yak Tunnel.

A fairly complete electrical installation has beeen made to furnish power to the mines of the Yak Mining, Milling and Tunnel Company, at Leadville, Colo. This company mines its own properties, and hauls ores and wastes for other mines which are tapped by the tunnel, all of the work being done by electric power. The tunnel was originally driven for draining purposes. At first, material was hauled through it by means of mules, but as it grew longer, this method became too slow and expensive, so that an electric railway two and one-half miles long was installed. The power plant consists of a 425-kilowatt, sixty-cycle, 6,600-volt, revolving-field alternator driven by a cross-compound Corliss engine, and a seventy-five-kilowatt, 250-volt, direct-current generator, which was the original machine. There is also an 800-cubic-foot compressor driven by a 150-horse-power, 440-volt, three-phase motor, besides a number of small auxiliaries driven mostly by motors. From the power-house, transmission lines extend to the Horseshoe substation, where power is supplied to the tunnel proper. Here there is a transformer station at the tunnel level, consisting of three 125-kilowatt transformers. There is a motor-generator at the Cord station, consisting of a 100-horse-power, three-phase, 440-volt induction motor belted to a seventy-five-kilowatt, 250-volt generator supplying power to the railway. From the Horseshoe station the lines are extended to the Vinnie substation, where there are transformers for lowering the pressure to 440 volts for hoisting and lighting purposes. At this point the tunnel is about 1,300 feet below the surface. Between these two stations power is tapped off for the Hopmore shaft, where there is a fifty-horse-power hoist operated by an induction motor. The Horseshoe station supplies power also for a hoist at the Willard winze and a pump at the Cord winze, and, besides, supplies power to several small diamond drills. The hoists are operated by variable-speed induction motors, but all other apparatus except the locomotives is driven by squirrel-cage motors. The hoisting motors are generally rated at fifty horse-power. The compressed-air drills were operated by air from the large compressor, but it has been found more satisfactory to transmit power electrically to a local station near the point of the work, where small electric compressors are run; and from these the air for operating the drills is obtained. This avoids the necessity of long lines, with their consequent losses, and gives a more flexible and efficient system. Each of these small compressors operates two or three drills. The haulage is done by three locomotives, weighing five tons each, and operating at 250 volts on a nineteen-inch gauge. Telephones have been installed throughout the entire mine, and at all the power-houses. Power is supplied from the station, also, to the Leadville mill of the American Zinc Extraction Company, which is driven entirely by electric motors, there being over 400 horse-power installed. At this mill magnetic separators are employed.—*Abstracted from the Engineering and Mining Journal (New York), May 25.*

The First Rateau Regenerator Installed in America.

A description is given here by F. G. Gasche of what is said to be the first Rateau steam regenerator installed in America. This plant was erected at the works of the International Harvester Company, Chicago, Ill., the object being to utilize the exhaust steam from a large rolling-mill engine. The regenerator consists of a cylindrical wrought-iron shell three-eighths of an inch in thickness, eleven feet six inches in diameter and thirty feet feet long. It is divided into two compartments by a central horizontal diaphragm. In each compartment there are six elliptical tubes or steam distributing conduits, which extend from end to end in pairs, space being left between them. Baffle plates are arranged above the space between each pair of tubes. The spaces surrounded the conduits, and under certain conditions even the conduits themselves, are filled with water, so that the tops of the latter are usually submerged three or four inches. Steam enters at one end, passing into the elliptical tubes, and finds its way out through the perforations, up through the water, and by means of another pipe, to a low-pressure Rateau steam turbine. The regenerator condenses the steam received from the engine when this is in excess of that used by the turbine, but when the latter begins to draw steam at a more rapid rate than it is furnished to the regenerator, steam is produced in the generator to make up the difference. It has been found that the method of construction described maintains the circulation of the water, which facilitates the liberation of steam. It has also been found that the whole body of water within the generator participates in the regenerative action. Steam is taken from the top of the regenerator to the turbine. The pressure can be regulated by a relief-valve attached to the former. This regenerator contains fifty-five tons of water, which is sufficient, by actual test, to deliver all the steam for a fifty per cent load on the turbine for a period of 430 seconds, and at full load for 390 seconds. The turbine is rated at 500 kilowatts. The adaptation of the regenerator to the turbine is a local problem for each given case. As the work done by the rolling engine is very irregular, a receiving drum is interposed between it and the regenerator, so as to allow the ready escape of steam from the engine without increasing the back pressure upon it. The generating unit consists of a 500-kilowatt turbine direct-connected to two 250-kilowatt, direct-current generators. Tests of the regenerator have shown that it is of sufficient capacity to operate a 750-kilowatt unit under the conditions obtaining at the works. The results of the operation of this unit show that it is very economical. The average duty on the engine is about 1,000 horse-power, although it varies greatly during a cycle of operations. This is working with a back pressure of about seventeen pounds absolute, and the average consumption is about sixty-four pounds of steam per indicated horse-power-hour. The turbine receives the steam at thirteen and one-half pounds absolute, discharges it into a condenser and develops one kilowatt-hour for about thirty-four pounds of steam, with an output of about 500 kilowatts. The results show that the steam from this engine would be sufficient to develop about 1,500 horse-power in turbines operating as described.—*Abstracted from Power (New York), June.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

A Plan, How It Worked and What It Will Do.

The central station logically needs the good will of the people. You naturally look to the people for your profits, but before you secure their money you must secure their friendship, or at least, temper their antagonism. The means of doing this are many and they are all possessed of some merit and consideration.

PEOPLE OF BLANKVILLE!

¶ Spend your money with the Merchants of Blankville—

THEY ARE YOUR FRIENDS

You go to them to borrow money when you get in a tight place—

YOU PATRONIZE THEM when you are out of money—and you get the goods. Be honest and stick to home trade through thick and thin.

Montgomery, Ward & Company do not pay for lighting on streets of Blankville; neither do Sears, Roebuck & Company pay taxes in Blankville!

The ONLY WAY to have a GOOD TOWN, and a prosperous town, is for all to stand together.

¶ Stand by those who stand by you.

The advertisement as suggested in the January 24 issue of the ELECTRICAL REVIEW.

Take, for instance, the idea we prescribed not long ago in this department of creating a friendlier feeling among merchants, by the central station assisting the merchants in combating the retail mail-order firms. This little plan can be worked at very little expense, and the wonderful amount of good it would do could not be had in other ways by many times the expenditure.

The idea was simply to insert an advertisement in the daily papers and to show the people of the town by good, strong, logical argument the advantage of trading at home, and by some sensible reasoning why the retail merchants should receive the patronage of the townspeople.

The writer was not aware that this little scheme was ever worked by any central station until he ran across a central station whose president casually remarked that he had used the plan.

It was on his visit to the Iowa City Electric Light Company, of Iowa City, Iowa, where he was informed by George S. Carson, president of the company, that he had been very favorably impressed with the article in this department of the ELECTRICAL REVIEW on "how the local merchant may be won over to become a strong and aggressive ally of the lighting company," and had acted on the advice given in the article. He, as a trial, ran the advertisement suggested by the writer in the local paper of Washington, Iowa, where his company is also operating a central station.

The advertisement was a surprise to the local merchants and appeared as follows:

People Of Washington!

SPEND YOUR MONEY

With The

Merchants of Washington

THEY ARE YOUR FRIENDS.

YOU go to them to borrow money when you get in a tight place, you patronize Them when you are out of money, and you get the Goods. Be honest and stick to HOME TRADE through thick, and thin. Montgomery Ward & Co. do not pay for lighting on streets of Washington; neither do Sears, Roebuck & Company Pay TAXES IN WASHINGTON. The only way to have a Good Town and a Prosperous Town, is for ALL to Stand Together.

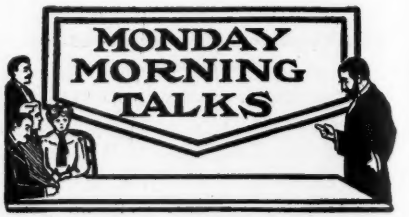
Stand by Those Who Stand by You AND KEEP STANDING!

Iowa Gas & Electric Co.

The advertisement as run by the Iowa Gas and Electric Company.

Mr. Carson was very enthusiastic about the results from this advertisement, and was firm in his belief that it did considerable good. He stated that the next day the merchants of the town kept dropping in on him to point out their heartfelt thanks for the little boost he gave them and the good which would no doubt result, especially as the advertisement was put out by a disinterested party.

In many towns you could, without a doubt, win the merchants and business men over to your side by such an advertisement, and there is little doubt that the rest would follow, if you go about it in the right way and follow up your advantage. It would be the means of arousing considerable brotherly feeling, which can not help make things "easier sailing," and generally more pleasant, satisfactory and profitable for your central station.



Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

The question recently came to me, "what is one of the greatest requirements that a salesman should have and which so many do not possess?"

And immediately this question answered itself by my remembrance of the many salesmen with whom I come in contact every day.

Boys, that one thing is "tact."

A prominent writer has said, "Tact is the axle grease that makes the wheels of commerce turn smoothly."

Now, you all know how these same wheels are inclined to stick and turn slowly at the many little differences that appear. And you all know how absolutely necessary it is that they be kept lubricated and running smoothly.

Take your own cases the past week. Can't you look back and see where you might have landed at least one more contract if you'd rubbed that prospect the right way? Did you say just the right thing to him at the right time?

That's tact.

You've got to handle some people with gloves, and the more you study this proposition the more you'll find that the solicitors that make the biggest successes are the ones that have a big supply of this same tact.

If little complaints come up, or dissatisfaction over seemingly unfair treatment, it is your place, your business, to use tact in smoothing these over. Rub that buyer the right way, and he'll purr like a kitten, rub him the wrong way and he has his back up immediately.

Tact is a thing to be admired, and feared in others; a thing that will make us admired and feared. If you haven't a big supply of this article on hand, get a grip on some. If you have lost contracts by not using it, go back and use liberal doses on these same people.

Take another course this coming week and inject into your work, not only your selling ability and knowledge of your product, but some of this business-bringing tact.

If you would have more business, more success, you must make a study not only of electricity, but of the people you meet and are trying to interest in electricity.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

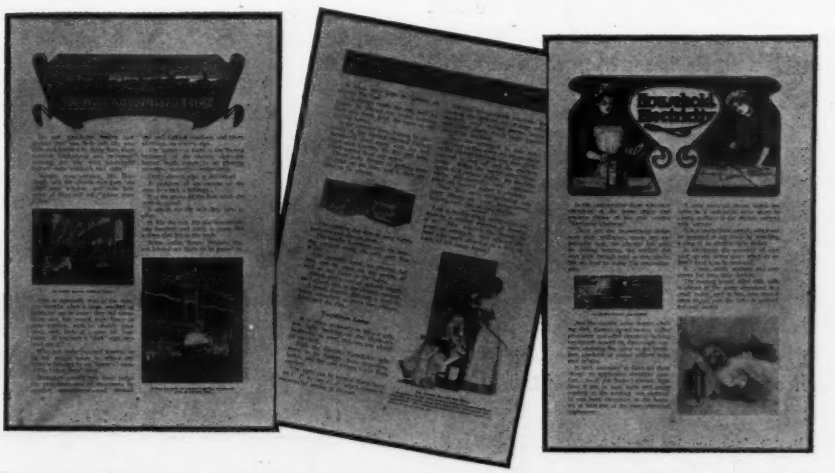
Newport News—From a mere hamlet to a large and prosperous city of 27,000 inhabitants in the short space of ten years is a record that stands second to that of no city in this great country of ours.

Such is the record established by the prosperous city of Newport News, a town situated at the lower end of the Virginia peninsula, where the waters of the historic James empty into Hampton Roads.

Newport News numbers among her industries the largest ship-building plant in the world; she has a shoe factory, a tobacco factory, a steel plant, car factories, wagon works, tanneries, paper mills, silk, knitting and hosiery mills, and last, but not least, an aggressive electric light plant.

Illustration showing cover and two inside pages of a well-gotten-up booklet or envelope enclosure of the Edison Illuminating Company, Detroit, Mich.

Newport News, besides its other reasons for fame, is mighty near the centre of the stage this year, as it is directly opposite to Norfolk, the city of the Jamestown Exposition.



Showing three of the inside pages of the excellent bulletin of the Newport News & Old Point Railway and Electric Company. It is printed in two colors, black and buff, which produces a very handsome and attractive effect.

This world's fair will do much to boom the city, as there are indications that the "big show" will be very successful.

The Jamestown Exposition will illustrate a somewhat different phase of American progress than has been shown at any of the five preceding shows, and it may be said to round out the series which America has given within the past fifteen years.

The Chicago show was an undigested mass of exhibits, relying for its attraction upon its bigness and its novelty.

The Buffalo exhibition had the definite purpose of bringing forward the idea of Pan-American unity.

The Atlanta fair was to exalt and exhibit the kingship of cotton in the industrial world.

The St. Louis exhibition was truly a world's fair, and was conceived and executed much in the same spirit of the now famous Missouri slogan, "show me."

The Portland show was to emphasize the great progress made by the Pacific Coast states and the Pacific commerce with the countries of the Far East.

But the Jamestown Exposition will take note of the historical development and evolution of this country, with special reference to the South's part in that development; and it will be an object lesson of the military and naval powers of the world. Natural resources, manufactures, and the arts and crafts are not to be neglected.

The Newport News & Old Point Railway and Electric Company also operates the commercial and residence lighting in Hampton, and Old Point Comfort, besides working in conjunction with several street railway lines and interurban systems connecting with the surrounding towns.

They are naturally very much interested in the Jamestown Exposition and its suc-

cess, and they have issued a beautiful and attractively illustrated folder telling about the exposition. This will be sent all over the country.

The managers of the company are strenuous, enterprising men, who are firm believers in advertising electricity, and they are out after new business with all their might and main, and their zeal and faith in publicity for their central station is growing more and more as they see the results which it is accomplishing.

The company publishes in connection with its three plants an electric bulletin, which goes out each month to a good list of customers and prospects, spreading the gospel of electricity, together with its use and superiority for the many domestic and commercial purposes.

For example, the bulletin contains in each issue a good article with an illustration or so on the advantages of electric light in the home—its cleanliness, brightness, healthfulness, safety, economy, convenience and the many other points which it has in its favor. Of course the different articles are written in an entirely different style each issue and take up the transcendence of electric light in different phases.

An article or so is almost always sandwiched in on the paramount usefulness, efficiency, comfort, etc., of some of the many electrical household devices, such as the electric flat-iron, chafing dish, sewing machine motor, food warmer, cigar lighter, coffee percolator, heating pad, radiator, cooking utensils, etc.

These articles make extremely interesting reading for the people, and the fact that they are written up in a strong, convincing manner has its effect in arousing a desire for electricity.

The compiler of this company's "Electrical Bulletin" never overlooks the importance of devoting a page or so to the how and why of electric power, and to give some good, sensible, logical reasons why it bears the palm over any other means of motive force known. The bulletin also devotes considerable space to interior store lighting and store-window lighting, and the electric sign is hardly ever forgotten.

In appealing to merchants and business men, the bulletin gets right down to business on the level with the business man's appreciation and understanding. It lets every argument sound as personal and convincing as if it had been prepared especially for the one man who reads it. It avoids stock phrases, stereotyped arguments and the technical terms which the readers have probably never heard of. It contains just those fine points that appeal to the merchant who has never yet got up his nerve to put up an electric sign, etc.

A set of neat miniature bulletins or envelope enclosures being sent out by the Grinnell Electric and Heating Company, Grinnell, Iowa.

On the whole, this company's bulletin is one of the best written, best illustrated, best printed, best arranged and best compiled bulletins of its kind published in America.

Along with its bulletin the Newport News & Old Point Railway and Electric Company is mailing out each month a series of forceful mailing cards, folders, booklets, facsimile letters, etc., devoted entirely to the illumination of the interiors and windows of stores and business places. This service or series of direct-by-mail advertising backs up the educational value of the bulletin and is nothing more or less than a carefully planned "follow-up" system. As a matter of fact, such a "follow-up" system is simply a straightforward, persistent endeavor to get business. It is not a new thing, although the term "follow-up" is comparatively so. It is the opposite to the "go-as-you-please" variety. It is not like the old style. The old style was haphazard, the modern is systematic.

If more central station managers would look into the merits of such advertising and make use of it there would be fewer gas-lit houses and stores and fewer light plants worrying along paying small dividends.

SIGNS OF PROGRESS
A Brighter Future for Marion
What benefits Marion benefits each and everyone of us. And for that reason we offer to meet the mercnants and property owners in the business districts more than half way in boosting and brightening up Marion.
The question is this: "Marion After Sunset." Because the sun has gone down, it does not mean your rent has stopped; your taxes have ceased; your insurance does not continue. The people of Marion do not retire at sundown. With the business section brilliantly illuminated it will help make Marion the leading trading center of this section of the state. The very people we want to reach are the workers. The wage-earners have no time to be on the street except evenings—this is the time they roam about looking, seeing, formulating and deciding on their purchases.
You do not have to hunt up the place of business that is outlined with electric lights, or has an electric sign, or brilliantly illuminated windows. Like searchlights, they hunt up the people. They are seen from afar and talk to you all along the street. To see the crowds you go to the best lighted districts.
We have a special inducement to offer the business men of Marion. For the illuminating of the public square we offer to erect a large arch at each corner, and from the center of each arch a streamer to run to the dome of the court house which will contain colored lights.
WE OFFER TO ERECT, MAINTAIN AND FURNISH CURRENT FOR THESE ARCHES AND STREAMERS FOR THE SUM OF $35.00 PER MONTH FOR EACH CORNER. WE ASK IN ALL FAIRNESS—DO YOU NOT CONSIDER THIS A MOST LIBERAL PROPOSITION? AND WE SOLICIT YOUR CO-OPERATION IN CARRYING FORWARD THIS IDEA FOR A
BIGGER, BUSIER, BRIGHTER MARION
Marion Light and Heating Co.
"Flash Bright at Night"
ELECTRIC SIGNS

A full page advertisement of the Marion Light and Heating Company, of Marion, Ind., which appeared in one of the local newspapers. It is well designed and well written, and is only another indication that central stations are becoming judicious users of all kinds of advertising.

Grinnell, Iowa — Among the enter-

prising and progressive central stations of the smaller towns of the Middle West, there is none more actively hustling than the Grinnell Electric and Heating Company, of Grinnell, Iowa, for the amount of business it does or the diligent efforts it puts forth to accomplish its end.

O. K. Cole, the president of this company, is (like his initials) "O K" when it comes to commercial aggressiveness.

Household Economics Division
D W C
Reception and Lecture
Monday evening April 1st 1907
Cards at door
L D Mathes
The Household Economics Division
of the
Dubuque Woman's Club
invite you to attend a Reception and
the first of a series of Lectures on
The Science of Housekeeping
by Mrs F Violet Sanborn
Lecturer and Writer on Domestic Science
Monday evening, April first
eight to ten o'clock
at 438 Main Street
Please send acceptance to
Mrs C H Hamilton

Illustration showing neat invitation, admission card and business card of the general manager of the Union Electric Company, of Dubuque, Iowa, sent to the ladies of Dubuque, inviting them to attend a series of lectures on the science of housekeeping, conducted under the auspices of the Union Electric Company. All the different electrical appliances were taken up and explained at the various lectures to show the utensils necessary in modern housekeeping.

The fact that he has placed among his customers more electric flat-irons than are often found in towns of many times the size of Grinnell is proof that his efforts are being "crowned with success." This active company has placed twenty-four washing-machine motors in the different household laundries of its town, and six complete cooking outfits are being operated on its circuit, besides many individual cooking appliances and some 235 electric flat-irons, which is "going some" for a town of Grinnell's population. We believe that if accurate statistics were taken it would be found that this company has more electric irons in operation *per capita* than any company in the United States.

This is a strong statement, but when it is considered that Grinnell has only about 5,000 of a population, which makes one iron for every twenty-one people, or an iron in one-fourth of the homes, we do not think the statement will be challenged.

The offices of the company are located on one of the principal streets in the centre of the town, and large display windows, well-dressed and well-arranged, present an attractive appearance. In the windows are displayed numerous electrical devices, lamps, fixtures, etc., which attract the passer-by, which is influential in making the people familiar with the many electrical appliances.

Mr. Cole is doing everything in his power to familiarize himself and employés in all matters pertaining to the practical uses of electricity for household and commercial purposes. He has fitted up what might be called an experimental room, where he tests out the different electrical devices, thus knowing their workings as well as the manufacturers themselves, and oftentimes he can materially add to their efficiency by his personal knowledge of the conditions necessary to good performance. By the knowledge he gains in this way he is able to intelligently explain the everyday operation of the articles to his help and his customers.

In popularizing and introducing electric cooking, Mr. Cole hit upon the practical scheme of making the Ladies' Congregational Society a very attractive offer of a complete electric cooking outfit for use in preparing church suppers or refreshments for the various social functions which are continually being held. The ladies of the society, as expected, accepted his offer and were greatly delighted with their modern kitchen. Electric cooking became the one topic of conversation, and as there is no gas to be had in Grinnell, the outlook is extremely promising for the installation of a large number of electric kitchens.

Mr. Cole is an advocate of good advertising, and he is sending out some very attractive envelope enclosures or miniature bulletins, as they might be called. These small bulletins, or "Electric Chats," as they are entitled, are entertainingly written, well-illustrated and neatly gotten up. They cover the entire field of usefulness of electric current and are sought after and perused by the company's customers, as well as a large number of prospects. Besides these "Electric Chats," the company is also sending out clever envelope enclosures with its monthly statements and letters.

Utica Gas and Electric Company Extensions.

The Utica Gas and Electric Company of Utica has made application to the state gas commission for consent to issue $2,000,000 five per cent fifty-year bonds under its mortgage for $5,000,000. The company also asks authority to acquire the capital stock of the Herkimer County Light and Power Company, the Glens Falls Gas and Electric Light Company, the Consolidated Light and Power Company of Whitehall, and fifty-one per cent of the capital stock of the United Gas, Electric Light and Fuel Company. The proposed bond issue of the Utica company is to pay for improvements and extensions, to complete the purchase of the capital stock of the companies mentioned, and to provide for its own floating indebtedness and that of its constituent companies.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Electric Pyrometers for Industrial Use.

The pyrometers which up to the present time have been most usually employed are of the thermo-electric type with thermo-couples of platinum and its alloys and with a rather delicate suspension coil galvanometer. In all thermo-electric pyrometers the current, which is set up in two dissimilar wires which are made into a junction at one end, is measured as a means of determining the temperatures under observation, it being the property of such wires to deliver a current bearing some definite relation to the difference in temperature between the extremities of the wires. Of course it was always necessary to take into account the resistance of the wires that connect the thermo-couple to the galvanometer; at least if the resistance of the leads was not considered by the user it was because the maker had provided in some way for rendering that resistance negligible. This was usually done by making the galvanometer with a very high internal resistance, usually several hundred ohms, so that in using the instrument long or short leads of copper wire could be used without causing an appreciable difference in the reading of the instrument. Now the current received from the platinum and rhodio-platinum thermo-couples usually employed is very weak, and with the high-resistance galvanometers it was necessary to rely upon an exceedingly delicate suspension-coil instrument which must be kept horizontal with the aid of levelling screws, and must be set upon a firm foundation. In the accompanying illustration (Fig. 1) is shown a galvanometer of very low internal resistance. It is a double-pivot instrument and is designed for use as a wall or portable indicator and does not have to be levelled up. It is a dead-beat instrument.

The thermo-couple used in the "Advance" electric pyrometer which is the pyrometer employing the above-mentioned indicator, has as its two elements pure iron, in the form of a tube and a special alloy formed as a rod and passing down through the tube, being insulated from it with asbestos. The tube and the rod are formed into a junction at one extremity, where they are electrically welded. Both the rod and the tube are of very large cross section, so that their resistance is small.

By using copper leads of suitable cross section the resistance of the whole circuit, including indicator, leads and thermo-

FIG. 1.—DOUBLE-PIVOT, LOW INTERNAL RESISTANCE INSTRUMENT.

couple, is quite small; but even so, nearly all of whatever resistance there is, is in the galvanometer, which is calibrated with a definite resistance in the combined thermo-couple and leads. If longer leads are to be used, they will be of larger cross section. The advantages of this type of pyrometer are several. The instrument is easy to read, for the dial is ten inches in diameter. This means a good deal, for the workman may read the temperatures of his furnace from any position within ten or fifteen feet of the galvanometer instead of being required to walk up to the instrument every time he takes a reading. Again, this galvanometer has the advantage of not being delicate, though it is sensitive and will not be affected by vibrations, but is an instrument that is suitable to the works. The fire-rod is inexpensive, so that a large number of them may be installed, having one at each place where the temperatures are of any interest, all the fire-rods being connected to a switch near the indicator. Moreover, there is nothing about the fire-rod that can be injured by rough handling, and this is a great advantage in all furnaces where heavy pieces must be moved about. The fire-rods are supplied in several lengths and can be bent to fit.

The instruments are supplied in ranges from 0° to 900° Fahrenheit and 0° to 1,800° Fahrenheit, or in corresponding ranges in degrees Centigrade. It has not been deemed advisable by the company putting this instrument on the market to offer it for temperatures above 1,800° Fahrenheit. Up to the temperature that this instrument is calibrated for the thermo-couples will hold their calibrations. Where temperatures in excess of 1,800° Fahrenheit are encountered it is much better to employ thermo-couples of platinum or rhodio-platinum, which make the only elements that will actually hold their electromotive force for periods of long heating at a white heat. In other words, it is the old Le Chatelier pyrometer that must be called into play.

Formerly, as stated before, very delicate instruments of the suspension coil type were used to measure the current from the platinum thermo-couple, but there is now constructed a very sensitive galvanom-

FIG. 2.—WALL PATTERN LE CHATELIER PYROMETER.

eter of the single pivot type which does not have to be levelled up and which has automatic devices for locking and releasing the coil and needle. This makes the instrument largely independent of vibration, renders it portable, and in general

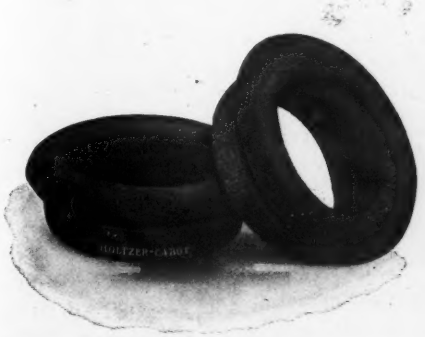
changes the Le Chatelier from a delicate laboratory instrument to a practical works instrument.

In Fig. 2 is shown an illustration of the wall pattern of a galvanometer of an improved Le Chatelier pyrometer. This galvanometer is also made in a portable case. It sometimes happens that one desires to use low temperatures at one time and high temperatures at another. These galvanometers are graduated in millivolts as well as in the temperature scale, the latter corresponding to the platinum, or rhodio-platinum thermo-couple. By using thermo-couples of base metals, which are quite inexpensive and which are supplied with a chart showing temperature equivalents for millivolts delivered by the couple, one of these galvanometers, by means of its millivolt scale, can easily be used for the lower temperatures in such a way that a full deflection of the needle is obtained for a very moderate temperature range.

Both of these new industrial pyrometers are being put on the market by the Wilson-Maeulen Company, 110 Liberty street, New York city.

Rubber Air-Cushion Receiver Caps.

The Holtzer-Cabot Electric Company, Brookline, Mass., has placed on the market a rubber air-cushion receiver cap, designed to fit over that portion of either a bipolar or watch-case receiver which comes



RUBBER AIR-CUSHION RECEIVER CAPS.

in contact with the ear. These caps are much softer and more comfortable than the bare hard-rubber shell. The cap fits snugly and keeps out all disturbing noise. These caps have been used extensively on head-band receivers for switchboards, where the receiver is held close to the ear by a steel head-band. The company states that the cap has become very popular.

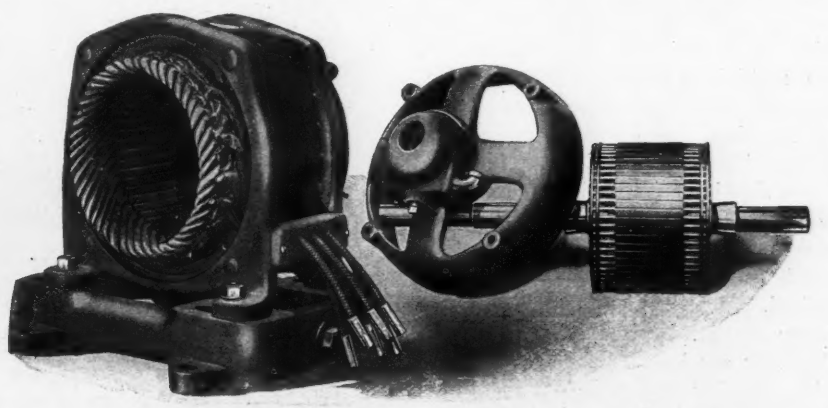
Fort Wayne Type S Single-Phase Motors.

The accompanying illustrations show several of the details of the type S single-phase motor manufactured by the Fort Wayne Electric Works, Fort Wayne, Ind. There are many conditions involving the use of single-phase alternating-current for lighting purposes. Where individual demands for small-power units obtain, the type S single-phase motor will be found of great utility. Where there is a demand for power in small towns operating both a street-lighting system with a constant-current regulator, and a constant-potential incandescent lighting distribution from a small single-phase generator, the demand arises for a single-phase motor of small output, which will operate satisfactorily with the minimum of attention. For situations such as these this motor has been particularly designed.

TYPE S SINGLE-PHASE MOTOR. ONE-HALF HORSE-POWER, SELF-STARTING.

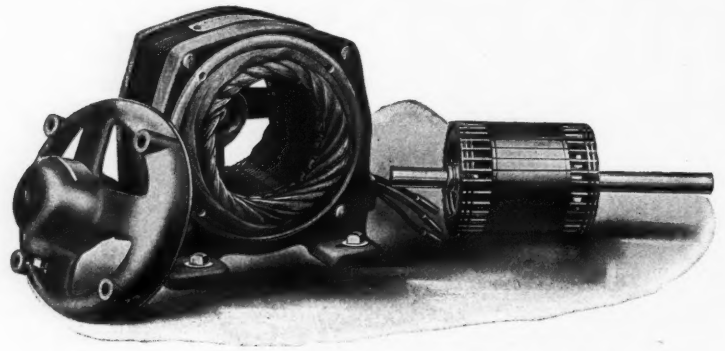
In the design of the single-phase motor certain limitations are met which make it difficult to secure a rotating field as long as the rotor remains stationary. With multiphase motors this matter is simplified by reason of the different phases reaching their maximum periods at such times as to conduce to a rotating field as soon as the main switch is closed. If, however, the rotor is brought up to a good percentage of its rated speed by some means, current introduced in the rotor, reacting upon the stator, will produce a rotation of the rotor, which will continue after the mechanical starting device has been removed, and permit the motor to carry its full rated load. Thus, the requirement in the design of the single-phase motor not necessary in the multiphase motor is some method of starting the single-phase motor by means of the single-phase current at hand. This difficulty has been successfully overcome, and the company states that it is in a position to absolutely guarantee perfect operation, especially in machines of small output.

The type S motor is made in two forms, respectively, form A and form B. Form A motors are furnished only in one-quarter and one-half-horse-power sizes, and are designated as hand-starting motors. These motors are for operating mechanisms requiring a small amount of power, where it is possible to give the motor an initial start with a hand pull upon the belt. Form B motors are furnished in sizes from one-quarter to fifteen horse-power, inclusive. These motors are of the same design as form A motors, but are made self-starting by means of a starting box containing a resistance reactance and a double-throw switch. This switch is first thrown to the starting position, and when the armature has attained almost



PARTS OF THREE-HORSE-POWER, TYPE S, SINGLE-PHASE MOTOR.

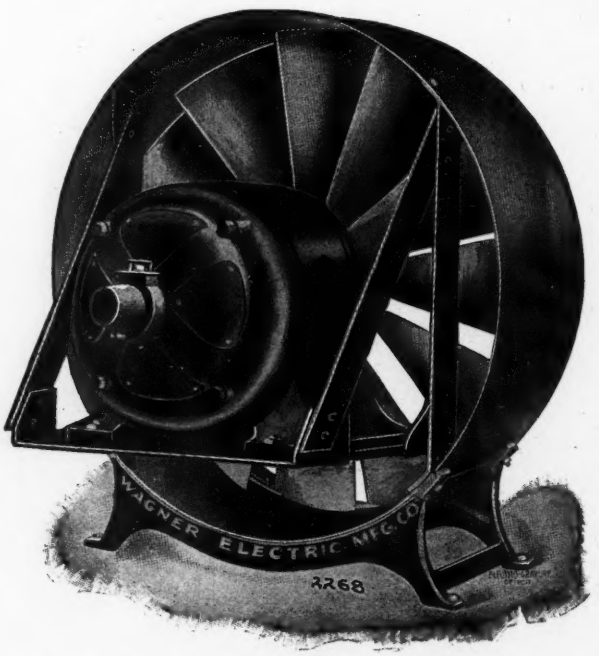
full speed it is quickly thrown over to the running position, the object being to first throw the resistance reactance in circuit with the motor, and later to disconnect it.



PARTS OF ONE-HALF-HORSE-POWER, TYPE S, SINGLE-PHASE MOTOR.

The general construction of both forms of type S single-phase motors is similar to that of the company's line of multiphase induction motors, the principal difference lying in the details of the windings. The stator laminations and frame are so provided with openings and ventilating ducts that a minimum temperature is maintained in these parts. The frame is circular in form, with removable end shields, the position of which can be shifted ninety or 100 degrees for wall or ceiling suspension, respectively. The armatures are of the high-resistance squirrel-cage type, consisting of a number of slotted soft steel discs assembled upon a shaft and carrying in the slots copper-bar windings, which extend beyond the core at each end and are permanently connected to short-circuiting rings. The windings are somewhat similar to those of the multiphase motor, consisting of a large number of coils placed progressively in the slots. The smaller motors are fitted with three terminals, while the larger sizes have six terminals. Iron sliding bases are provided for all motors above one-half horse-power, although they can be supplied without such bases if so desired. Motors of one horse-power and larger are fitted with clutch pulleys so that they can be started under full load while drawing only two or two and one-half times full load current. This pulley consists of a hub rigidly keyed to the shaft, with an outside enveloping cup upon which the belt runs. This cup is not supplied with any driving force until the motor has reached nearly its rated speed. Within the hub two weights are mounted and held in place close to the shaft, under the tension of a spiral spring, so long as the motor is at rest. With the increasing speed of the motor these weights fly out and thereby cause the flexible hub in which they are encased to expand sufficiently to grip the enveloping cup and cause the whole mechanism to turn. Thus, although the motor starts with no load, the load is automatically taken on without any attention.

Motors of both forms, of five horse-power and under, are designed for both 110 and 220-volt circuits, while motors from five horse-power to fifteen horse-power inclusive are furnished for 220-volt circuits. The latter range of motors may be furnished for 110-volt circuits, but the use of these motors at that voltage is not advised.



WAGNER SINGLE-PHASE, VARIABLE-SPEED VENTILATING FAN OUTFIT.

Single-Phase, Variable-Speed Ventilating Fan Outfits.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has produced a successful single-phase ventilating fan outfit, an illustration of which is shown herewith. The application of a standard single-phase motor to a ventilating fan, to be operated at a fixed speed, does not involve difficulties peculiar to that application; but when it is desired to obtain an outfit whose speed may be varied in accordance with the varying conditions existing in a given room, new difficulties are involved. With the equipment shown herewith, the principle employed for speed variation is that of the autotransformer connected to a regulating head, by means of which the actual voltage applied to the motor is controlled.

These single-phase, variable-speed ventilating fans with autotransformer control, as manufactured by the Wagner company, are suitable for offices, banks, storerooms, laundries, hotels, restaurants, kitchens, engine rooms, boiler rooms and dynamo rooms. The company believes that this outfit will prove an exceedingly valuable aid to central station managers who are seeking to obtain new business, and opens up a field which has belonged, more or less exclusively, to the direct-current motor heretofore. The motors used in this equipment are arranged with shields on the bearings, so that the suction of the air through the motor will not draw the oil from the bearings. The bearings are made of heavy cast phosphor bronze with ring oilers and oil reservoirs of large capacity.

These outfits are arranged so that they are easy to install. The ring is first mounted in the window or wall, and after it has been secured the motor is lifted to its supporting straps and bolted into place, the fan then being placed directly upon the motor shaft. The form of suspension adopted is very simple. The outfit consists primarily of a sheet-metal fan ring, to which is securely riveted the bracket. This bracket is suspended and rigidly fastened to the fan ring, and will bear, without strain, any thrust which may be placed upon it.

Electric Baggage Trucks.

For carrying baggage and mail between trains and the baggage and mail rooms of stations, the Pennsylvania Railroad Company has recently built three electrically propelled trucks. Two are in service in the Broad Street Station, Philadelphia, and the third is in Altoona.

Although similar in general appearance, the three trucks are not alike. They are regarded as still in the experimental state, and monthly reports of operation are compiled with a view of developing the best type for general use. The following description applies to the particular truck which has been found to be most serviceable up to the present time.

ELECTRIC BAGGAGE TRUCK.

In general appearance the truck is similar to the hand-drawn type universally used throughout the country. It is operated by one man, who walks ahead of it and steers it with a tongue, or handle, in the same way that he would if it were not electrically propelled.

Power is taken from a storage battery contained in a box secured to the under side of the platform near the middle. It consists of fourteen Willard cells and has a capacity of 136 ampere-hours. The batteries are charged about eight hours daily at the rate of seventeen amperes.

Each of the rear wheels is driven by a Westinghouse type AA, four-pole series-wound, twenty-volt motor. Double-reduction gearing is used between the motor and rear wheel, and each motor is provided with a solenoid brake of the multiple-disc type on the end of its shaft. These brakes form an essential element in securing safe operation; for the truck can not start of itself even if it is on an incline, and if it is in motion it stops promptly and automatically as soon as the power is shut off.

Control of the motor is made as simple as possible. Only two speeds forward and two backward are provided. These are approximately four and six miles per hour for the loaded truck, and on the crowded platforms they have been found fast enough.

The two motors are operated in series, and on the low speed a wire resistance is inserted. The motor current is controlled by two single-pole solenoid switches; one for the low and the other for the high speed. The solenoid switches are enclosed in a box directly in front of the storage batteries, and current for operating them is controlled by contacts in a small box on the outer end of the tongue or handle.

The contact box is of metal, cylindrical in form, and operated by a rod which slides axially through it. The rod is provided at one end with a ring, which is readily grasped by the operator. A slight movement of the rod starts the truck forward at low speed; further movement of the rod gives the high speed. The rod is returned to the off position by a spring, so that the instant the ring is released the truck stops. It can not be started by any accidental knock, but only by an intentional pull on the ring. The pole-changing switch for running the truck backward or forward is located in the box with the solenoid switches and operated by a small lever under the front of the platform. The tongue or handle is connected by reach rods to pivoted bell cranks carrying the two front wheels in a way similar to that generally used upon automobiles.

This truck has been in operation about six months and has won the confidence and approval of the men who use it. One man is enabled to handle the immense loads of baggage and mail quickly and without the usual tugging and pulling by several men.

The Yost Bench Drill.

The accompanying illustration shows the Yost portable, direct-driven, variable-speed bench drill manufactured by the Faure Electrical Works, Incorporated, of Ossining, N. Y. These machines have a present capacity from the smallest to a one-quarter-inch drill. The traverse of the spindle is two and three-quarter inches, and the traverse of the table five inches. The approximate speed range is from 800 revolutions per minute to 3,000 revolutions per minute in twenty-four steps. The drill is twenty-seven inches high and takes a bench space of twelve square inches. The net weight of the machine is seventy-five pounds, and it operates on 110 or 220 volts, direct current. The spindle is fitted with a one-quarter-inch Horton chuck.

THE YOST DIRECT-DRIVEN BENCH DRILL.

Current Electrical News

DOMESTIC AND EXPORT.

WESTERN POWER COMPANY—Further information concerning the plans of the Western Power Company, which, it is understood, Gould interests in the Western Pacific Railroad are backing, has come to hand. It appears that the company is capitalized at $18,000,000, of which $7,000,000 is being spent at Big Bend, where a plant is being developed to utilize the powers of the Feather river. A site has also been secured at East Oakland. It is said that Edwin Hawley, of New York, is at the head of the enterprise.

REORGANIZATION OF THE PACIFIC LIGHTING CORPORATION—The Pacific Lighting Company reorganized on May 20, and filed new articles of incorporation under the name of the Pacific Lighting Corporation. It is a $20,000,000 concern which supplies light, heat and power to San Francisco, Cal., and vicinity. The stock is divided into 200,000 shares of a par value of $100. George H. Collins, of Oakland, Cal., heads the list of directors. His associates include two prominent San Francisco capitalists, Charles Holbrook and Alfred Sutro. George F. Volkman and C. O. G. Miller also are members of the directorate.

MERGER OF IOWA TELEPHONE COMPANIES—The Mutual Telephone Company, Des Moines, Iowa, has increased its capital stock from $450,000 to $1,600,000, and will absorb the following companies, operating in the vicinity of Des Moines: Hawkeye Telephone Company, with seventeen exchanges; headquarters at Dallas Center, and connecting such towns as Perry, Winterset, Indianola and Valley Junction. The Boone County Telephone Company, five exchanges, with headquarters at Boone. This system embraces Ames, Ogden and other towns along the Northwestern. The Jasper County Telephone Company, which extends from Colfax eastward to Grinnell. The Iowa Southern Company, which has headquarters in Des Moines and maintains twenty exchanges extending to the Missouri line and embracing every town of importance in south central Iowa. The Knoxville Electric Company, with headquarters at Knoxville. This system extends southeastward through Oskaloosa and Ottumwa.

STREET OPENING SUIT IN NEW YORK CITY FAILS—The Court of Appeals affirmed on May 28 the judgment of the lower courts in the case of the People *ex rel.* New York Electric Lines Company *vs.* William B. Ellison, Commissioner of Water Supply, Gas and Electricity in New York city. The case involved the fight of the independent telephone companies of the state to get a foothold in New York city, the New York Electric Lines Company seeking to mandamus Commissioner Ellison and to require him to give permits for the opening of several streets in order that conduits might be laid. The Special Term denied the motion of relator for a temporary writ of mandamus. The motion if granted would have compelled Commissioner Ellison to give the company permission to lay subways for conduits for the installation of telephone wires. Commissioner Ellison contended that the company had no absolute right to compel the issuance of a permit to open the streets by virtue of its charter powers and a permission given by the board of aldermen. The opinions of the court are held temporarily subject to revision, but it is said that the decision is given on the ground that the board of electrical control had the right to impose limitations on construction of conduits and that the statutes did not give the company the right to lease its conduits.

NEW YORK CENTRAL PURCHASES THE O'ROURKE ENGINEERING AND CONSTRUCTION COMPANY'S PLANT—The O'Rourke Engineering and Construction Company and the New York Central & Hudson River Railroad Company completed on May 29 the cancellation of the contract of the former to do the excavating for the site of the Central's new terminal at and near the present Grand Central Station. The original contract of the O'Rourke people was for $8,000,000. They receive about $3,000,000, including about $400,000 for excavating plant. The plant has been bought by the Central, which proposes to go on with the work under its own management. George A. Harwood has been appointed chief engineer to take charge of the excavation operations. Unanticipated delays to the contractor, owing to the unexpected amount of increased traffic, were given as the prime reason for the cancellation of the contract. The Central says that while the contract has been cancelled, this does not mean that the work of completing the terminal will be given up. The O'Rourke company was using about 1,500 men on the work. It was stated at the New York Central's offices that the railroad would put on something like 5,000 men. Work on the Central's extensive terminal improvements began in 1903. For a couple of years the work was to some extent experimental. It is now less than half completed. Some of it has to be done by 1910. The O'Rourke company had the contract for excavating for the terminal in the Grand Central Station yards. It divided the work into three longitudinal sections or bites. It had completed the Lexington avenue bite. When it got to the second, or central bite, over which so many trains had to pass, delays began, resulting in the purchase of its excavating plant by the railroad company.

CHICAGO EDISON COMPANY HAS GOOD YEAR—The annual report of the Chicago Edison Company for the year ending March 31 has been issued. Gross earnings aggregated $5,317,359, or $572,536 more than those for the previous fiscal year, while operating expenses and renewals involved $3,610,110, leaving net earnings of $1,707,249, or $157,224 larger than those for the preceding year. Charges amounted to $365,249, compared with $363,976 for the previous year, leaving a surplus of $1,342,000, or $155,951 more than that for the preceding year. The amount laid aside for depreciation reserve was $100,000, the same as for the previous year, and the balance available for dividends aggregated $1,242,000, or $155,049 more than that for the preceding year. Dividend disbursements involved $999,846, or $112,290 larger than those for the previous year, as a result of the increase in the outstanding stock during the last fiscal year. The surplus for the year amounted to $242,154, or $43,661 more than that at the close of the previous year. The company's balance sheet, as of March 31, showed total assets of $25,312,933, compared with $21,938,028 for the previous year. Of these total assets, $20,703,712 represented the value of the plant, real estate and royalties; $445,091, material; $785,041, accounts and bills receivable; $3,189, unfinished plant investment; $245,577, cash, and $30,322, open accounts. Material gains in gross and net earnings as well as in surplus, are exhibited in the annual report of the Commonwealth Electric Company for the fiscal year ended March 31, which has been issued by that corporation. Unusually heavy expenditures for expansion and renewals and large disbursements on charges, however, curtailed the surplus for the year to $394,550, showing that 3.94 per cent had been earned on the company's $10,000,000 of capital stock upon which no dividends ever have been paid. The Commonwealth Electric Company was formed nine years ago by inside interests of the Chicago Edison Company for the purpose of combining the several electric light and power plants in the suburbs of Chicago, thereby giving to the Chicago Edison Company control of all the electric lighting and power business in that city.

EDUCATIONAL NOTES.

STEVENS INSTITUTE OF TECHNOLOGY—The thirty-fifth annual commencement exercises of the Stevens Institute of Technology, Hoboken, N. J., will be held on Thursday, June 13, at 10.30 A. M., in the auditorium of the institute.

COLUMBIA UNIVERSITY—An address on "Some Phases of the American Railroad Problem" will be delivered by Stuyvesant Fish, of the class of 1871, before the graduating class and alumni of the College of Applied Science, Columbia University, New York city, on Monday, June 10.

TELEPHONE AND TELEGRAPH.

JACKSON, MISS.—Franchises for an independent telephone company have been obtained in the cities of Jackson, Meridian, Vicksburg and Hattiesburg, by N. D. Smith.

GREENFIELD, MASS.—The New England Telephone Company has secured a franchise from the Leyden selectmen for rights to erect its lines over a number of roads in Leyden.

KRUMSVILLE, PA.—The New Rural Telephone and Telegraph Company will extend its line from Kempton to New Tripoli. Four additional wires will also be put up from Kutztown to Krumsville.

NEW LONDON, CT.—The Southern New England Telephone Company now has in operation a system by means of which the weather reports from the United States weather bureau in Washington, D. C., are sent out daily to every exchange in the state.

GREAT FALLS, MONT.—Officers of the Independent Telephone Company announce that they will begin the installation of an exchange here within a month and have it in operation before the end of the year. The company will erect its own building and place all wires in the business district under ground.

PROVIDENCE, R. I.—The report which the committee on the Home Telephone petition is to present for the consideration of the city council will recommend that a six-year exclusive franchise be granted to the Providence Telephone Company, which will pay three per cent on its gross earnings instead of upon rentals.

MANTI, UTAH—At a meeting of the Commercial Club, at which the subscribers of stock to the new telephone company were present, it was decided that the new company to be incorporated be called the Manti Telephone Company. A committee was appointed to get matters properly arranged so that a franchise can be asked for from Manti city and also to draw up the proper papers.

ALBANY, N. Y.—The stockholders of the Home Telephone Company at their annual meeting elected these directors: James Moore, T. Henry Dumary, William H. Keeler, Albert Hessberg, E. B. Toedt, Howard Hendrickson, Eli M. Woodard, Richard Stephens, Samuel B. Rawson, Irving H. Griswold, Theodore M. Brush, Frederick H. Sudro, E. F. Allen, E. E. Williams and Harry H. Bender. The only change on the board was the election of E. F. Allen in the place of W. E. Brooks.

PAMPLIN CITY, VA.—A company known as the Appomattox Telephone Company has been organized with the following list of officers: George T. Peers, president; John A. Sears, vice-president; B. F. Oden, secretary and treasurer. The directors are: L. E. Smith, R. F. Burke, S. L. Ferguson, H. D. Flood, J. R. Atwood, George T. Peers and B. F. Oden. W. A. Moses was elected manager. A large amount of stock has been subscribed and arrangements are being made to put in lines from Appomattox Courthouse to Evergreen, Pamplin City, Hixburg and other points in the county. The company is to have a capital of $15,000.

FRANKFORT, KY.—Judge Stout, in the Franklin Circuit Court, has rendered a decision in favor of the plaintiff in the suit of the East Tennessee Telephone Company against the city of Frankfort. The action was for a restraining order to prevent the city taking steps to force the company to reduce tolls in conformity to the rates of the Frankfort Telephone Company, fixed in a city ordinance for a term of ten years, beginning 1901. Judge Stout held the terms of the ordinance not sufficiently definite to apply to the East Tennessee company. The case has been before the Court of Appeals, which held the ordinance enforceable against the Frankfort company. The question as to the East Tennessee company has never been before that court.

WASHINGTON, D. C.—Plans have been made by the forest service for the construction of telephone lines in the National forests of Oregon, Idaho, New Mexico and Colorado. In the Bitter Root National forest, Idaho, the supervisor has been authorized to cooperate with ranchmen and settlers to construct a line from Koohis to the forks of the Clearwater river, a distance of twenty-five miles. A line from Tin Cup to Dorchester, on the Gunnison National forest, Colorado, a distance of twenty-four miles, will probably be begun soon. Contracts have been made for enough wire and other materials to construct 3,000 miles of lines for the National forests. This material will be distributed from Salt Lake and Denver and used for lines already authorized and those to be started soon.

COLORADO CITY, COL.—Several citizens of Colorado City have organized a new telephone company and have asked for a franchise from the city council. The new company plans to extend its wires to all the leading cities and towns of the state as fast as the franchises can be secured. Those who are pushing the scheme were formerly large stockholders in the El Paso Telephone Company, which went bankrupt a year ago and was purchased by F. J. Pickens. The El Paso Telephone franchise was given to H. C. Kinsman and M. H. Spere, but the backing of the company was not large enough and it was mortgaged to R. M. Handy, who foreclosed when the money was due, and sold the poles, wires, etc., to Pickens. Pickens formed the Home Telephone Company and has been operating it under that name and under the El Paso Telephone Company franchise up to the present time. If the franchise is granted the work of constructing a new system will be commenced at once. The general offices will be located in Colorado City.

ELECTRICAL SECURITIES.

Last week witnessed a continuance of the decline in prices, and brought the whole list very close to the low figures reached in the March slump. Following a break on Monday, there was a slight recovery toward the latter part of the week. This recovery, however, was not sufficiently extensive to prevent net declines in a number of issues as compared with the previous week. The continued cold weather and reports of further damage to crops forced prices for wheat to a new high level, but subsequently there was a slight reaction. It is generally held that future developments in the market will be more or less dependent on the crop outlook, and that favorable weather will offset any damage which has been done to date. Gold shipments to the extent of over $3,000,000 were made during the week, causing call money to rise to 3 per cent and rendering time money firm.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JUNE 1.

New York:	*Closing.*
Allis-Chalmers common	9½
Allis-Chalmers preferred	27⅛
Brooklyn Rapid Transit	49¾
Consolidated Gas (ex-dividend)	117½
General Electric	139
Interborough-Metropolitan common	18½
Interborough-Metropolitan preferred	50½
Kings County Electric	120
Mackay Companies (Postal Telegraph and Cables) common	67
Mackay Companies (Postal Telegraph and Cables) preferred	68
Manhattan Elevated	136
Metropolitan Street Railway	93
New York & New Jersey Telephone	110
Western Union	79⅛
Westinghouse Manufacturing Company	143

Figures compiled by the Westinghouse Electric and Manufacturing Company show that for the year ended March 31 last orders aggregated $34,170,647; shipments $29,189,844, and collections $30,549,894. For the six years ended March 31 last orders aggregated $131,638,432; shipments $128,736,491, and collections $132,111,001.

Boston:	*Closing.*
American Telephone and Telegraph	115½
Edison Electric Illuminating	212
Massachusetts Electric	52½
New England Telephone	115
Western Telephone and Telegraph preferred	70

Philadelphia:	*Closing.*
Electric Company of America	9⅞
Electric Storage Battery common	50
Electric Storage Battery preferred	50
Philadelphia Electric	8
Philadelphia Rapid Transit	21¾
United Gas Improvement	90½

Chicago:	*Closing.*
Chicago Telephone	122
Chicago Edison Light	144¾
Metropolitan Elevated preferred	65
National Carbon common	72
National Carbon preferred	112
Union Traction common	—
Union Traction preferred	—

Directors of the South Side Elevated Company have declared a regular quarterly dividend of 1 per cent, payable June 30. Books close June 19 and reopen July 1.

NEW MANUFACTURING COMPANIES.

NEW YORK CITY, N. Y.—The Lee & Bellmer Company has been incorporated with a capital of $10,000 to deal in electrical materials. The directors are W. I. Lee, Hackensack, N. J.; E. F. Bellman, Brooklyn, and Frank Hamilton, Jamaica, N. Y.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Standard Safety Boiler Company, of Fort Wayne, Ind. The capital stock is $50,000, and the directors are Samuel K. Gregg, Charles E. Colerick and Walter M. Gregg. The company manufactures horizontal and vertical water-tube boilers.

BINGHAMTON, N. Y.—Articles of incorporation of the Olenin Electric Company have been filed. The new concern is capitalized at $75,000. The seven directors named in the certificate are Alexis Olenin, of New York, the inventor of the new light; Purdy M. Randall, also of New York, and the following Binghamtonians: John B. Frear, William L. Betts, Frederick E. Ross, John A. Gale and Rollin W. Meeker. The company proposes the manufacture of the new Olenin flaming arc light in this city. At a meeting of the directors of the company the following officers were elected: president, John M. Frear; vice-president, Alexis Olenin; secretary and treasurer, Frank Merifield. P. M. Randall, John M. Frear, and W. L. Betts will have charge of the sales department, Alexis Olenin of the factory, and Frank Merifield of the office.

ELECTRIC RAILWAYS.

MARSHFIELD, ORE.—For the building of an electric line to connect up the peninsula of Coos Bay $60,000 has been subscribed by Marshfield and North Bend residents.

MACON, GA.—The survey for the line of the Macon, Americus & Albany Electric Railway has been completed and bids for construction work will soon be called for.

BELLINGHAM, WASH.—W. H. Blood, chief engineer of the Stone & Webster Company, of Boston, states that active work on the construction of the interurban line from Bellingham to Skagit county will be started within two months.

SUPERIOR, WIS.—Grading for the Twin City & Lake Superior line will be started about June 15, both at Superior and at the Twin City end. It is expected that trains will be running by the summer of 1908.

ASTORIA, ORE.—The county court has granted a thirty-year franchise to E. B. McFarland and S. D. Adair for an electric line between this city, Warrenton, Flavel and Hammond. Under the terms of the franchise, the line is to be in operation within two years.

CINCINNATI, OHIO—The Springfield, Wilmington and Cincinnati Railway Company has executed a mortgage to the Knickerbocker Trust Company to secure a $4,000,000 bond issue. The company proposes building from Springfield through Clark, Green, Clinton and Warren counties to Cincinnati.

CHICAGO, ILL.—The Metropolitan West Side Elevated Railway Company has secured a franchise from the town of Cicero to build a four-mile line from the Western Electric plant on the Douglas Park Branch through to Clyde. The cost will be $25,000 a mile, but the project will not be begun in the near future.

BALTIMORE, MD.—The Hamstead & Manchester Railroad of Carroll county is planning to extend its line from Reisterstown to the Pennsylvania line to connect with an extension of the Hanover & McSherrystown railroad, giving a through line from Hanover to Baltimore. Gettysburg is said to be the objective point.

ALBANY, N. Y.—The Buffalo, Genesee & Rochester Railway has been incorporated to operate an electric road sixty miles from the village of Depew, Erie county, to Rochester, with a branch to the village of Leroy, Genesee county. The capital will be $7,500,000. Directors include H. H. Kingston, J. A. Harris, Jr., of Philadelphia; Herbert P. Bissell and John T. Mooney, of Buffalo.

AUBURN, N. Y.—At a meeting of the board of directors of the Auburn & Northern Electric Railroad Company assurances were given that the newly constructed line to Port Byron will soon be in operation. A vote was taken on the proposition of extending the company's lines westward to Seneca Falls, resulting in the affirmative. The work of building the Auburn & Seneca Falls branch will be started soon.

INDIANAPOLIS, IND.—The board of public works has granted a franchise to the Terre Haute, Indianapolis & Eastern Traction Company, the merger line that controls and now operates all the Morgan-McGowan-Schoepf interurban lines entering the city. The franchise is the same as that granted all the other traction lines in the city, and was sought only for legal purposes.

SAN FRANCISCO, CAL.—The San Francisco Railway and Power Company has been incorporated to do a general railway business in the city of San Francisco and is incorporated for fifty years. The capital stock is placed at $1,000,000, with $10,000 subscribed. The incorporators are B. F. Clarke, F. C. Boekmann, George K. Ford, George E. Bennett and J. R. Sloan, all of whom are named as directors for the first year.

ATLANTA, GA.—The Street Railway and Power Company, recently organized at Americus, Ga., has obtained the necessary franchises and announces its intention of posting the required bond of $25,000, guaranteeing compliance to terms of contract with the municipal authorities. About $150,000 will be invested in electrical equipment and an initial circuit of four miles of street railway will be operated.

INDIANAPOLIS, IND.—Articles have been filed with the secretary of state for the incorporation of the Seymour & Brownstown Interurban Motor Line Company, to run between the two cities in the name of the corporation. The capital is $10,000 and the directors are Joseph I. Irwin, Linnie I. Sweeney, Nettie I. Sweeney, Elsie H. Sweeney and Z. T. Sweeney, all of Columbus. The home office of the company is to be at Seymour.

INDIANAPOLIS, IND.—The Terre Haute & Merom Traction Company has been incorporated. The company will build a traction line from Terre Haute to Merom, a distance of thirty miles. The capital stock will be $750,000. Work will be begun within two months. The survey has been completed and deeds to nearly all the right of way have been obtained. The incorporators are: Lafayette Brown, H. L. Bartlett, R. L. Ruby, J. F. Oldbuck, J. T. Barrett, Frank S. Lewis, A. E. Hays and Virgil Pounds.

NASHVILLE, TENN.—The Nashville Railway and Light Company of Tennessee has filed its new refunding and improvement mortgage to the Guaranty Trust Company, of New York, as trustee, to secure an issue of $15,000,000 five per cent, forty-year gold bonds. Of the authorized amount $2,000,000 is issuable for corporate purposes, $6,000,000 is reserved and can be issued only upon retirement of a like amount of underlying bonds, and $7,000,000 is reserved to be issued at the rate of $1,000 for each $1,250 expended for future improvements.

PENN YAN, N. Y.—Farmers of the town of Jerusalem and business men of Prattsburg are endeavoring to bring about an extension of the Prattsburg Railroad, which is sixteen miles long and connects with the Erie. The proposed extension would run to Branchport from Prattsburg, a distance of ten miles. The whole twenty-six miles would then be electrified, and as the line would connect with the Penn Yan, Keuka Park & Branchport trolley line it would mean a continuous stretch of electric road thirty-four miles in length.

PORTLAND, ME.—It is expected that work will begin at once on the construction of an electric railroad from Portland to Bridgton, through Westbrook, Windham, Raymond, Casco and Naples, for which the petition of the Portland & Northern Railroad Company has been approved by the state railroad commissioners. It is to be standard gauge and forty miles long. The company is capitalized at $160,000 and William M. Sturges and N. D. Sturges, of Scranton, Pa., and Tracy W. Holland of New York city, are the principal shareholders.

PORTLAND, ORE.—A trust deed for $15,000,000, made out in favor of the Trust Company of North America, covering all the properties of the Portland Railway, Light and Power Company, has been filed at Portland, Ore. The amount of the mortgage is half the value of the properties owned by the company. The deed provides for taking up underlying bond issues against subsidiary corporations owned by the Portland Railway, Light and Power Company, and also for extensions and improvements and for the issue of bonds of the denomination of $1,000 at five per cent. It is the purpose of the company to spend $1,250,000 this year on improvements of various kinds.

PERSONAL MENTION.

MR. PAUL LA RUE has been appointed manager of the Fairmount (Ind.) plant of the Central Indiana Lighting Company.

MR. V. R. LANSINGH, general manager Holophane Company, with headquarters at its sales department, 227 Fulton street, New York city, has returned from a six weeks' business trip to the Pacific Coast.

MR. L. C. BRADLEY, of Columbus, Ohio, has resigned as superintendent of the Scioto Valley Traction Company, and has joined the engineering staff of J. G. White & Company, of New York. Mr. Bradley was formerly superintendent of the Seattle & Tacoma Interurban Railway Company, and went to Columbus about three years ago.

MR. ADELBERT GILLETTE, of Escanaba, Mich., has accepted the position of superintendent of the Sterling, Dixon & Eastern Electric Railway Company, to fill the vacancy caused by the resignation of John Powers, whose appointment with the electric light plant of the McKinley system at Galesburg, Ill., was announced last week.

MR. C. W. KOINER, who has been filling the dual position of secretary-treasurer and engineer of the National Light and Improvement Company, operating the Wichita (Kan.) Gas, Electric Light and Power Company, the Fort Worth (Tex.) Light and Power Company, the Citizens' Railway Company, of Waco, Tex., and the Waco Gas Company, has resigned to accept the position of general superintendent and engineer of the Los Angeles Gas and Electric Company, Los Angeles, Cal.

MR. FRANK W. PARDEE has severed his connection with Frank B. Cook, Chicago, Ill., to become treasurer of the Durant Electric Supplies Company, also of Chicago. Mr. Pardee has been identified with the telephone and general electrical field for about seven years, and has a wide acquaintance. While with Mr. Cook he had charge of the company's advertising and solicitors, the business increasing to a large extent during his connection with it. Mr. Pardee was presented with a handsome gold watch at a dinner given in his honor by the office and shop employés.

MR. G. U. G. HOLMAN has been appointed manager of the electrical department of the Boston branch of the H. W. Johns-Manville Company. Mr. Holman is well known in electrical circles. He is a graduate of the Massachusetts Institute of Technology, and was, for several years, associated with the Thomson-Houston and General Electric Companies in Lynn, Mass., New York city and Minnesota. In 1892 he became railway engineer with the Mather Electric Company, Manchester, Ct., later engaging in the lighting field in Philadelphia for five years. During the last few years Mr. Holman has been connected with the construction and operation of electrical enterprises in New York, Philadelphia and Canada.

MR. JOHN N. SHANNAHAN, general superintendent of the Fonda, Johnstown & Gloversville Railroad, Gloversville, N. Y., has resigned to become general manager of the Washington, Baltimore & Annapolis Electric Railway, Washington, D. C. Mr. Shannahan was made inspector of signals on the western division of the New York Central July 1, 1895, with headquarters in Rochester, N. Y., where he remained until May 8, 1899, leaving to take the position of chief engineer with the Fonda, Johnstown & Gloversville road. He was promoted to general manager January 1, 1903. Mr. Shannahan is succeeded by Master Mechanic William H. Collins, of the same road.

MR. WILLIS V. SWEETEN, formerly of the Elmer P. Morris Company, New York city, is now connected with the Electric Service Supplies Company, Philadelphia, Pa. Mr. Sweeten will travel through New York state, making his headquarters at the New York city office of the company, No. 2 Rector street. Mr. C. F. Peck, formerly real estate agent for the Delaware & Hudson Railroad Company, is now connected with the Electric Service Supplies Company in Philadelphia, covering the Philadelphia trade. Mr. T. F. McKenna, who for some years has been traveling for Machado & Roller, New York city, is now connected with the Electric Service Supplies Company, traveling in Pennsylvania, making his headquarters at the Mayer & England department in Philadelphia, Pa.

NEW INCORPORATIONS.

INDIANAPOLIS, IND.—Royse Electric Company. Capital increased to $50,000.

SAN FRANCISCO, CAL.—Pacific Lighting Company. Capital increased to $20,000,000.

AUSTIN, TEX.—The Home Light, Water and Ice Company, of Blooming Grove. $30,000.

AUSTIN, TEX.—The Springtown Telephone Company, of Springtown, Parker County. $5,000.

IOWA CITY, IA.—Farmers' Mutual Telephone Company. Capital increased from $4,500 to $9,000.

HARTFORD, CT.—The East Haven Telephone and Electric Company has filed a notice of an increase of capital stock from $3,000 to $5,000.

ASBURY PARK, N. J.—Federal Light, Heat and Power Company. $125,000. Incorporators: John B. Sabine, Douglas R. Clarkson and Daniel W. Moore.

GUTHRIE, OKLA.—The Valley Green Telephone Company, of Aline. $1,000. Incorporators: F. M. Riburn, J. H. Elkins and J. D. Durham, of Aline.

MILWAUKEE, WIS.—Washington County Telephone Company, Schlesingerville. $1,500. Incorporators: John F. Kramer, Charles D. Storck, and M. Maxam.

SPRINGFIELD, ILL.—Mt. Pulaski Independent Telephone Company, Mt. Pulaski. $5,000. Incorporators: Herman Rentmeister, S. C. Dawson, Wm. Baumann.

SPRINGFIELD, ILL.—Northern Illinois Gas, Electric Light and Water Company, Chicago. $25,000. Incorporators: Leander D. Condee, Edward J. Closs, Bertha G. Kuehn.

NASHVILLE, TENN.—Round Lick Telephone Company, Smith County. $1,000. Incorporators: N. A. Neal, E. A. Kennedy, R. E. Cooksey, A. F. Tuggle and C. A. Shaver.

ALBANY, N. Y.—The Otsego & Schoharie Power, Heat and Light Company, East Worcester, Otsego County. $10,000. Directors: J. E. Sante, A. D. Hallenbeck, Lucy A. Dante, East Worcester.

BIG RAPIDS, MICH.—Broomfield & Millbrook Telephone Company of Millbrook. Officers: John W. Sellers, president; Albert Collier, vice-president; John W. Collier, treasurer; George W. Dowell, secretary; Ruben Miller and Charles Furney, managers.

SCRANTON, PA.—Clark's Summit & Lake Winola Street Railway Company. $48,000. Directors: Thomas B. Rodham, of Scranton; William Allen, of Peckville; J. D. Keator, of Scranton; C. A. Keller, of Scranton, and Frank P. Benjamin, of Peckville.

HARRISBURG, PA.—Waynesburg & Monongahela Street Railway Company. To build fourteen miles of road from Waynesburg to Millsboro. $84,000. President, Jesse L. Ross, Waynesburg; directors, E. L. Denny, W. P. Ely, G. M. Scott, W. A. Titus, Waynesburg.

HARRISBURG, PA.—Philadelphia, Valley Forge & Suburban Street Railway Company. To build a line six miles long from the western terminus of the Philadelphia Elevated Railway Company at Darby to Lower Merion. $60,000. President: L. Knowles Perot, Bala.

HARRISBURG, PA.—Penn Eastern Railroad; $150,000; to build a fourteen-mile line in Pike County, near Dingman's Ferry; William V. Hilliard, of Milford, president. Rockwood & Bakersville Railway Company; to build a nine-mile line in Somerset county; Charles F. Hood, of Connellsville, president.

JOLIET, ILL.—Rockford, Oregon & Southern Railway Company. To be constructed from Rockford, Ill., through the counties of Winnebago, Ogle and Lee to Dixon, Ill. $10,000. Incorporators and first board of directors: Frederick C. Jones, Charles D. Etnyre and Arthur F. Herbert, of Oregon, Ill., and Louis C. Wachsmuth and Fred H. Wachsmuth, of Chicago.

MONTPELIER, VT.—At the annual meeting of the Vermont Telephone and Telegraph Company held in Montpelier, it was voted to increase the capital stock from $50,000 to $125,000 and to increase the board of directors from seven to nine. The directors elected are: A. C. Brown, J. G. Brown, H. J. M. Jones, of Montpelier, N. D. Phelps, of Barre; F. A. Houston, J. N. Kelley, F. W. Story, N. D. Jones, and C. T. Kelley, of Boston.

ELECTRIC LIGHTING.

TURNER, ME.—E. L. Staples has purchased B. W. Knapp's water privilege and will build a power-house below North's Grist Mill.

READING, MASS.—At a special town meeting, $26,000 was voted for the improvement of the electric lighting plant.

NEVADA CITY, CAL.—The Bay Counties Power Company has begun the construction of a line from the Rome power-house to the Alaska Quartz mine at Pike City, a distance of ten miles.

SIDNEY, IA.—The city council has ordered a special election to be held June 10 to vote on the question of a twenty-five-year electric light franchise to be granted E. B. Hillman, of Quincy, Ill.

NEW HAVEN, KY.—Thomas Kirkpatrick, of Hodgenville, will establish an electric lighting plant at New Haven. The motive power will be furnished by a local planing mill.

MILLVILLE, PA.—The people of Millville will vote on the proposition to issue bonds to the amount of $20,000 for the purpose of increasing the capacity of the present borough electric light plant.

MORRISTOWN, N. J.—The board of aldermen at a special meeting voted to give the street lighting contract to Peter V. Stryker, of Bernardsville, who represents capital in that place.

NEWBERN, N. C.—Arrangements have been completed for turning over the municipal electric lighting plant, after ten years of unsuccessful operation, to a private corporation.

MONTGOMERY, ALA.—The Citizens' Light, Heat and Power Company, of Montgomery, has increased its capital from $50,000 to $200,000.

LARAMIE, WYO.—The Laramie Light and Power Company's plant, owned largely by Colorado capitalists, will be enlarged by the addition of a 250-horse-power boiler and a 150-kilowatt dynamo.

WESTERLY, R. I.—The Westerly Power Company has received about fifteen miles of wire for the new pole line to Stonington. When completed the borough will be lighted from the Westerly plant.

LANARK, ILL.—H. S. Green, of Morrison, has purchased the Pulford electric light plant at Savanna, which will be absorbed by the Savanna Gas and Electric Company now being organized to operate under a franchise awarded Mr. Green.

GREENFIELD, ILL.—J. T. Callaway, of this city, has purchased the electric light plant from Lewis Solomon, the plant and real estate bringing $8,000. The plant will be rebuilt and additional machinery installed.

WILLOW, CAL.—The Snow Mountain Power Light Company has been organized to supply Colusa and Yolo counties, and later Glenn county, with electric power. C. H. Glenn and Al Lindstrom are back of the company.

ATLANTA, GA.—Directors of the North Georgia Electric Company have elected D. W. Stewart, of Xenia, Ohio, president, to succeed General A. J. Warner. The local management of the corporation remains in the hands of W. A. Carlisle, of Gainesville, Ga., who was re-elected vice-president.

VERGENNES, VT.—At the annual meeting of the Vergennes Electric Company, the following officers were elected: C. E. Parker, president; E. S. Marsh, of Brandon, vice-president; Frank K. Goss, of Montpelier, secretary; C. E. Parker, treasurer. The report of the different officers showed the company to be in a good financial condition.

CINCINNATI, OHIO—The Columbia Gas and Electric Company, the corporation which expects to lease the Cincinnati, Newport & Covington Light and Traction Company, has applied to have its securities listed on the Cincinnati Stock Exchange. The securities include $50,000,000 of common stock and $10,000,000 out of an authorized issue of $25,000,000 five per cent bonds.

BARRE, VT.—George H. Almon, of Montpelier, and G. E. Moody, of Waterbury, who own the electric power plant in Moretown, have purchased three farms in Waterbury and are to develop another water power on the Mad river. The expense of development will be $100,000. Work will be begun in the early fall and the plant will be completed during the summer of 1908.

PAWTUCKET, R. I.—The Pawtucket Electric Company will spend $200,000 in doubling the capacity of the Tidewater street power plant. The Stone & Webster Engineering Corporation, of Boston, will have charge of the work. The old reciprocating engines, with a total capacity of 2,000 horse-power, are to be replaced by Curtis' steam turbines.

NEVADA CITY, CAL.—Over 160 men are now at work on the new Deer Creek power-house. The plans of the company contemplate a big piece of work, involving an expenditure of three-quarters of a million dollars. Work has been commenced on a reservoir site, which will be 500 feet in diameter. Work will be continued on the plant until the last of next November.

PATERSON, N. J.—The board of public works has decided by unanimous vote to award the contract for public lighting to the Public Service corporation at $77.50 per arc light, and incandescent lights for public buildings at eight cents per kilowatt-hour. By agreement it is provided that the rate for commercial incandescent lighting shall be ten cents per kilowatt-hour, beginning January 1, 1908, and shall be incorporated in the contract. According to the new contract, the rate for arc lights will go into effect July 1, and will run for the two unexpired years of the old contract and five years from July 1, 1909, or seven years in all.

OBITUARY NOTES.

MR. JOHN A. WALKER, vice-president and treasurer of the Joseph Dixon Crucible Company, Jersey City, N. J., died at his home in Jersey City on May 23. Mr. Walker was born in the city of New York, September 22, 1837. He was educated in Brooklyn, N. Y., and had his first business experience in New York city. After serving during the Civil War he became connected with the Joseph Dixon company in 1867, and in 1868 was made its secretary. This position he held until 1891, when he was elected vice-president and treasurer, which office he held without interruption until his death. Besides his work with the Joseph Dixon Crucible Company, Mr. Walker was interested in outside duties, serving as director in a number of insurance and trust companies, benevolent societies and commercial organizations. He leaves a widow.

MR. GEORGE S. CHAPMAN, vice-president and general manager of the United Railroads of San Francisco, Cal., died in that city on Friday, May 24. He was forty-five years old. Mr. Chapman was formerly general superintendent of the North Jersey Street Railway Company, at Newark, N. J. He left that city for San Francisco in 1903. Born in England, Mr. Chapman came to this country when he was a boy. He settled in Boston, and when he came of age he started in the street railroading business as a car conductor. He spent three years at the work in Boston and Worcester, after which he went to New Jersey, where he became an assistant to John Ackerman, superintendent of the Elizabeth division of the North Jersey company. He was placed in charge of the division and was later transferred to Orange, where he managed that division. Shortly after he was made superintendent of the lines of the North Jersey in Newark, Elizabeth, Orange and Jersey City. He leaves a widow and a son.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Railway Master Mechanics' Association. Annual meeting, Atlantic City, N. J., June 12-14.

Pacific Coast Electric Transmission Association. Los Angeles, Cal., June 18-20.

Association of Railway Telegraph Superintendents. Annual meeting, Norfolk, Va., June 19.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 20-22.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., June 25-28.

New York State Street Railway Association. Annual meeting, Pine Bluff Point, N. Y., June 26-27.

Society for the Promotion of Engineering Education. Case School of Applied Science, Cleveland, Ohio, July 1-3.

National Electrical Contractors' Association. Annual meeting, New York city, July 17-19.

International Association of Municipal Electricians. Norfolk, Va., August 20-22.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

Canadian Electrical Association. Annual convention, Montreal, Quebec, September 11-13.

INDUSTRIAL ITEMS.

FORD, BACON & DAVIS, New York city, announces its removal from 24 Broad street to the United States Realty Building, 115 Broadway.

THE PRATT & WHITNEY COMPANY, Hartford, Ct., has published a valuable catalogue devoted to illustrating and describing the products of its small tool department.

THE SCHAEFFER & BUDENBERG MANUFACTURING COMPANY, 66 John street, New York city, has published two handsome catalogues devoted respectively to steam gauges and to brass goods and engineering specialties.

THE BRILLIANT ELECTRIC COMPANY, 1134 Chestnut street, N. E., Cleveland, Ohio, has published an attractive folder illustrating and describing Holophane reflectors for high-efficiency Gem, Meridian and tantalum lamps.

GUNN, RICHARDS & COMPANY, New York city, is distributing a valuable treatise entitled "Foundry Costs," by William Francis Russell, a member of the company. This is an interesting and practical study of the economics of this service. Copies will be sent to any one interested upon request.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa., has published a catalogue descriptive of telephone apparatus for railways. These telephones have been especially designed and manufactured to meet the demand of electric railways. They are also suitable for mining work.

THE AMERICAN ELECTRIC FURNACE COMPANY, 45 Wall street, New York city, announces that it has taken over all the business pertaining to electric furnaces heretofore carried on by the American Grondal Kjellin Company, of New York, and the Induction Furnace Company, of Newark, N. J., and has acquired all patents relating to electric furnaces taken out by F. A. Kjellin and E. A. Colby, which were owned by these companies.

DODGE & DAY, engineer and constructor, whose main offices are in the Drexel Building, Philadelphia, Pa., has extended its business by opening an office in the United States Realty Building, 111 Broadway, New York city, which has been placed in charge of Robert T. Lozier, who has for some years been prominently connected with the electrical field. The new office is said to have already closed contracts for several industrial and public utility plants.

THE EXCELLO ARC LAMP COMPANY, 24-26 East Twenty-first street, New York city, announces a large number of installations of "Excello" flaming arcs abroad. The foreign centres in which these installations have been made include many portions of London, Blackpool, Hornsey, Halifax, Liverpool, Bradford, Derby, Brighton, Wolverhampton, Leicester, Exeter, Manchester, Newcastle and Leeds, in England; Adelaide, Melbourne and Sydney, Australia; Johannesburg, South Africa; Buenos Ayres, South America, and Yokohama, Japan.

THE NATIONAL ELECTRIC LAMP ASSOCIATION, Cleveland, Ohio, through its engineering department, is distributing the second edition of its bulletins, which are devoted to the following topics: bulletin No. 1, the National Electric Lamp Association; bulletin No. 2, the engineering department of the National Electric Lamp Association; bulletin No. 3, the Gem metallized fifty-watt lamp; bulletin No. 4, Gem metallized high-candle-power and "Prismo" lamps and units; bulletin No. 5, the tantalum lamp; bulletin No. 6, the tungsten lamp.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, has published in bulletin No. 12 a very interesting lot of information concerning the care of electric mine locomotives in service, compiled by F. L. Sessions. This book has been prepared primarily for consulting engineers, mine managers, superintendents, electricians, mine bosses, machine runners, motormen and engineers. Users of electric locomotives are invited by the company to write it freely upon questions of this nature, and the bulletin will be sent to any one interested upon request.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., announces that it opened a supply house on April 15 at 230 Lee street, Atlanta, Ga., with a complete stock of general electrical supplies. This company has recently completed the construction of its new Atlanta plant, located on the Central of Georgia Railroad, a short distance from the centre of the city. The building has an available floor space of 60,000 square feet, and is well adapted to handling the heavy stock which is to be carried. O. D. Street has charge of the Atlanta branch.

THE SPRAGUE ELECTRIC COMPANY, of New York city, has opened a district office in the Hennen Building, New Orleans, La., which has been necessitated by the constantly increasing business in its various products in the Southern territory. This office is under the management of F. V. L. Smith, lately chief inspector of the Louisiana bureau of fire prevention, and will cover the territory included in the states of South Carolina, Florida, Alabama, Georgia, Tennessee, Mississippi, Louisiana, Arkansas, Texas, Oklahoma and Indian Territory.

THE ZOAR STORAGE BATTERY COMPANY, Zoar, Ohio, has published a handsomely illustrated catalogue showing various types of storage batteries made by the company, and replete with detailed information concerning this product. The "Zoar Spun" plates are so developed that the claim is made that absolutely all the active material is retained in place, ensuring dependability and durability when the battery is placed in service. Illustrations of the Zoar Storage Battery Company's plant are given in this catalogue, and show the facilities which the company has for producing a wide range of storage batteries.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has ready for distribution its catalogue No. 190,610, covering Ward Leonard battery charging rheostats for electric automobiles, for garage and private plant duty. This catalogue illustrates a typical garage installation, showing Ward Leonard battery charging rheostats and combined over-load and under-load release circuit-breaker. It also illustrates a typical private plant switchboard. The catalogue covers rheostats having a ten-to-one taper in ampere capacity, rheostats having the same ampere capacity throughout, and rheostats having a five-to-one taper in ampere capacity. This catalogue will be sent to any one interested upon request. The company has recently enlarged its enamel plant, in order to take care of the increasing demand for battery charging rheostats and other standard enameled rheostats and resistance units.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Ct.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings fourth Friday of each month. Annual meeting, Niagara Falls, N. Y., June 25-28.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill. Annual meeting, Atlantic City, N. J., June 12-14.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnston, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, N. J., June 20-22.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city. Annual convention, Mexico City, Mexico, beginning July 8.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 12 West Thirty-first street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, assistant treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, S. W. Mower, London, Canada.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Ernest H. Davis, Williamsport, Pa.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, P. C. Brown, Boston, Mass.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada. Annual convention, Montreal, Canada, September 11-13.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, president Toronto Suburban Railway, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, W. F. Millholland, secretary and treasurer Indianapolis Traction and Terminal Company, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Ct.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary Rolland A. Davidson, 58 William street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. B. C. Cheadle, Joliet.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Texas.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, S. C. Norton, Indianapolis.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting Norfolk, Va.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.; assistant secretary, J. A. Harney, Electric Building, Cleveland, Ohio.

IOWA STATE ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. S. Vivian, Grand Rapids, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James F. Barnett.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, New York city, July 17, 1907.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Toledo, August 20, 21 and 22.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore. Annual meeting, Los Angeles, Cal., June 18-20.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Milwaukee, Wis., October 8-10, 1907.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Annual meeting, Atlantic City, N. J., June 19-20.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, So. Dak.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, general manager Rochester & Eastern Rapid Railway, Canandaigua, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, Chicago.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

Record of Electrical Patents.

Week of May 28.

854,709. ELECTRICAL MEASURING INSTRUMENT. Joseph Abrahamson, Detroit, Mich. The actuating coil supports the moving element.

854,712. CONTROLLING MOTORS AT A DISTANCE. Norman C. Bassett, Lynn, Mass., assignor to General Electrical Company. A motor-operated valve.

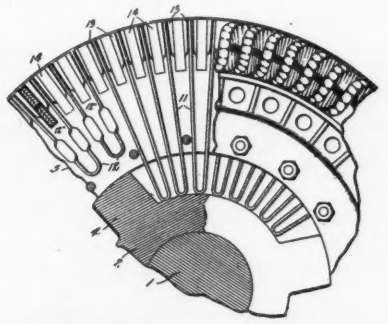
854,717. DYNAMOELECTRIC MACHINE. Walter M. Coffman, Madison, Wis., assignor to Northern Electrical Manufacturing Company. A method of core construction.

854,721. MOTOR CONTROL. Maxwell W. Day, Schenectady, N. Y., assignor to General Electric Company. A control system for two motors.

854,723. THERMAL CUTOUT. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. An enclosed fuse.

854,724. THERMAL CUTOUT. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Means for preventing arcing in an enclosed fuse.

854,727. DEVICE FOR CONTROLLING ELECTRIC CURRENTS. Henry B. Emerson and George H. Dorgeloh, Schenectady, N. Y., assignors to General Electric Company. A starting rheostat.



854,717.—DYNAMOELECTRIC MACHINE.

854,730. CONTROL OF ELECTRIC CARS. John J. Frank and Jesse S. Pevear, Schenectady, N. Y., assignors to General Electric Company. A control system for alternating and direct currents.

854,739. ALTERNATING-CURRENT MOTOR. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Two coils are placed on the secondary element.

854,741. REVERSE-PHASE RELAY, Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. A relay operated by a shifting field.

854,743. MOTOR-CONTROL DEVICE. Andrew Kidd, Jr., Schenectady, N. Y., assignor to General Electric Company. Controller for a multiple voltage system.

854,748. RESISTANCE UNIT. Frederick Mackintosh, Schenectady, N. Y., assignor to General Electric Company. Insulating washers are locked between the loops of the conductor.

854,749. POWER-TRANSMISSION MECHANISM. Campbell Macmillan, Schenectady, N. Y., assignor to General Electric Company. Utilizes a unipolar generator.

854,751. CUTOUT. John T. Marshall, Metuchen, N. J., assignor to General Electric Company. An automatic cutout.

854,756. DYNAMOELECTRIC MACHINE. Jacob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company. A homopolar machine.

854,759. TROLLEY-POLE. Lee Radcliff, Danvers, Ill., assignor of one-half to Addie Hay, Bloomington, Ill. A double-ended trolley-pole.

854,760. INDUCTION MOTOR. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. A short-circuiting device for induction motors.

854,764. THREE-PHASE-CURRENT ARC LAMP. Guido Semenza, Milan, Italy, assignor to General Electric Company. A three-carbon arc lamp.

854,772. REVERSING THE POLARITY OF DYNAMOELECTRIC MACHINES. John B. Taylor, Schenectady, N. Y., assignor to General Electric Company. A reversing switch.

854,773. EQUALIZING LOADS ON MOTOR-GENERATOR SETS. John B. Taylor, Schenectady, N. Y., assignor to General Electric Company. Utilizes a voltage-regulating transformer.

854,774. HIGH-VOLTAGE TRANSFORMER. John B. Taylor, Schenectady, N. Y., assignor to General Electric Company. The high-voltage winding has its greatest effective cross-section near its terminals.

854,777. ELECTRIC METER. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. An integrating meter.

854,780. COMBINED ANNUNCIATOR AND RINGER FOR TELEPHONE LINES. Henry Tideman, Menominee, Mich. A magneto bell and drop.

854,781. COMMUTATOR. Louis E. Underwood, Lynn, Mass., assignor to General Electric Company. Uses composite insulating segments.

854,781. DYNAMOELECVTRIC MACHINE. Louis E. Underwood, Lynn, Mass., assignor to General Electric Company. The poles are offset axially.

854,784. DYNAMOELECTRIC MACHINE. John B. Wiard, Lynn, Mass., assignor to General Electric Company. A distributed winding with taps.

854,804. TROLLEY-WHEEL. John C. Cordrey, La Junta, Colo., and Patrick J. Brady, Harvey, Ill.; said Brady assignor to George S. Codling, Chicago, Ill. A built-up wheel.

854,813. WIRELESS-TELEGRAPH SYSTEM. Henry H. C. Dunwoody, Washington, D. C. Uses a responsive device of magnetite.

854,817. FLEXIBLE ELECTRIC CONNECTION FOR STORAGE BATTERIES. Bruce Ford, Philadelphia, Pa. The terminals of the insulated leads are non-corrosive metal.

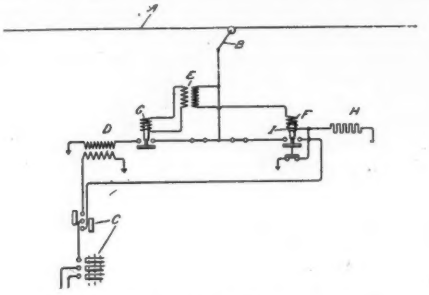
854,824. ELECTROMAGNETICALLY ACTUATED DEVICE. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The moving coil is short-circuited.

854,825. SYSTEM OF ELECTRIC-MOTOR CONTROL. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A multiple-switch controller.

854,827. SUSPENDING DEVICE FOR ELECTRIC-ARC LAMPS AND SIMILAR OBJECTS. Ernest Kuhne, New York, N. Y. A method of construction.

854,829. POTENTIAL-REGULATOR. Edwin Lehr, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A regulating transformer.

854,830. CALL-REGISTER FOR TELEPHONE SYSTEMS. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Means for damping signals are provided.



854,730.—CONTROL OF ELECTRIC CARS.

854,831. ALTERNATING-CURRENT APPARATUS. Ralph D. Mershon, New York, N. Y. A machine in which the connections of the coils may be shifted.

854,834. ELECTRIC HEATER OR RHEOSTAT. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. A resistance element of copper, nickel, zinc and ferromanganese alloy.

854,862. SYSTEM OF ELECTRICAL DISTRIBUTION. Joseph L. Woodbridge, Philadelphia, Pa. A polyphase alternating-current system.

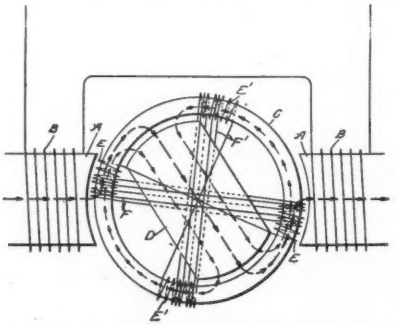
854,881. PORTABLE TEST-METER. Christian H. Evers, Birmingham, Ala. An adjustable meter.

854,892. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A unit switch control.

854,897. ARMATURE FOR DYNAMOELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The armature slots are wider at the top than at the bottom.

854,918. ELECTRIC GOVERNOR. Herman Weber, Colorado Springs, Colo. A centrifugal governor controlling the illumination of the car steps.

854,926. ELECTRIC RAILWAY SIGNALING SYSTEM. Antonio Casale, Scranton, Pa. A block signal system.



854,739.—ALTERNATING-CURRENT MOTOR.

854,965. OZONIZER. Henry N. Potter, New Rochelle, N. Y., assignor to Geo. Westinghouse, Pittsburg, Pa. Current is passed between electrodes contained in the envelope, permeable to ozonizing radiation.

854,970. ELECTRICAL BLOCK-SIGNAL. Elza S. Stotts and Lester O. Dickey, Omaha, Neb. A magnetically controlled signal.

854,978. CONNECTION FOR ELECTRICAL SOCKETS AND CONDUITS. Reuben B. Benjamin, Chicago, Ill. A conduit socket.

854,996. DYNAMOMETER. Claude M. Garland, Urbana, Ill. An eddy dynamometer.

854,997. APPARATUS FOR SEPARATING GOLD FROM MAGNETIC SANDS. Elmer Gates, Chevy Chase, Md., assignor by mesne assignments, to Washington Loan and Trust Company. Utilizes an ununiform magnetic field.

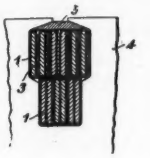
855,002. SECONDARY ELECTRIC CLOCK. William S. Guthrie, Terrell, Tex. The movement is controlled by a magnet.

855,010. ALTERNATING-CURRENT MOTOR. Marius C. A. Latour, Paris, France, assignor to General Electric Company. A commutator motor.

855,021. ELECTRIC SELF-PLAYING VIOLIN. Henry K. Sandell, Chicago, Ill., assignor to Mills Novelty Company. A device driven by a motor.

855,060. PROCESS FOR MANUFACTURE OF INCANDESCENT BODIES FOR ELECTRIC LAMPS. Alexander Just and Franz Hanaman, Budapest, Austria-Hungary, assignors to Egyesült Izzólampá és Villamossági Részvény Társasag, Uj-Pest, Austria-Hungary. Process for making tungsten filaments.

855,066. MEANS OF CONTROL FOR AN ELECTRICALLY ACTUATED BODY. Benjamin McInnerney, Omaha, Neb. A switch for automatically opening and closing the motor circuit.



854,897.—ARMATURE FOR DYNAMOELECTRIC MACHINES.

855,085. TELEGRAPH KEY. Benjamin F. Bellows, Cleveland, Ohio. Uses a vibrating controller for making and breaking a circuit.

855,114. SUSPENDER FOR THE CONTACT-WIRES OF ELECTRIC RAILWAYS. Joseph Mayer, Rutherford, N. J. A trolley-wire ear.

855,117. APPARATUS FOR TESTING TELEPHONE WIRES. James M. Miller and Clinton J. Murray, Newtown Square, Pa. A lineman's testing sett.

855,138. CROSS-ARM FOR CARRYING TELEGRAPH, TELEPHONE, OR OTHER WIRES AND ROPES. Henry M. Sciple, San Francisco, Cal. A method of attaching a plurality of cross-arms.

855,158. DEMAGNETIZER. Donald M. Bliss, New York, N. Y., assignor to Engineering Specialty Company. The demagnetizing solenoid has a double winding.

855,162. STOP MECHANISM FOR BOBBINS. Richard H. Cook, Fall River, Mass., assignor to American Thread Company, Fall River, Mass. A magnetically-controlled bobbin winder.

855,168. SIGNALING KEY. Oscar F. Forsberg and Jules A. Birsfield, Chicago, Ill., assignors to Western Electric Company, Chicago, Ill. A telephone key.

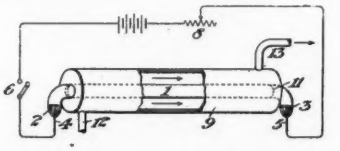
855,208. INSULATOR. Herbert Sinclair, Trenton, N. J. A compound insulator.

855,220. ELECTRIC METER. Riccardo Arno, Milan, Italy. Alternating-current meter.

855,249. SELF-WINDING ELECTRIC CLOCK. Maximilian Juruick, New York, N. Y. A motor-wound clock.

855,253. INSULATOR PIN. William S. Lee, Jr., Charlotte, N. C. A pin with a hollow conical metal base.

855,261. INSULATOR PIN. Louis Steinberger, New York, N. Y. The strengthening member is surrounded by an insulating jacket.



854,965.—OZONIZER.

855,300. LIGHTNING ARRESTER. William Gifford, Thompsonville, Mich. A multi-gap arrester.

855,355. HIGH-POTENTIAL INSULATOR. Louis Steinberger, New York, N. Y. A compound insulator.

855,389. ELECTRIC ATTACHMENT FOR MOVABLE OBJECTS. John R. Dawkins, McKinney, Tex. A grounding device.

855,391. TELEPHONE SWITCHBOARD. John M. Dosbaugh, Cedar Vale, Kan. A manual exchange system.

855,394. TELEPHONE. Oscar F. Falk, Boston, Mass., assignor to American Telephone and Telegraph Company. A hand telephone set.

855,395. TELEPHONE TRANSMITTER. Oscar F. Falk, Boston, Mass., assignor to American Telephone and Telegraph Company. The case containing the resistance button is set obliquely to the diaphragm.